7521

Indian
Science Congress Handbook

BANGALORE MEETING

JANUARY, 1924

For the Information of Members of the
Eleventh Annual Meeting of the
Indian Science Congress

WITH MAP

MYSORE:
PRINTED AT THE WESLEYAN MISSION PRESS
1923.

PAST PRESIDENTS

1914. The Hon'ble Justice Sir Ashutosh Mukerji, Kt., C.S.I., M.A., D.L., F.A.S.B.

1915. Major-General W. B. Bannerman, C.S.I., M.D., D.Sc., F.R.S.

1916. Colonel Sir Sydney Burrard, K.C.S.I., F.A.S.B., F.R.S., R.E.

1917. Sir Alfred Gibbs Bourne, K.C.I.E., D.Sc., F.R.S.

1918. Dr. Gilbert T. Walker, C.S.I., M.A., F.R.S.

1919. Lt.-Col. Sir Leonard Rogers, Kt., C.I.E., M.D., B.S., F.R.C.P., F.R.C.S., F.R.S., F.A.S.B., I.M.S.

1920. Sir Prafulla Chandra Ray, Kt., C.I.E., Ph.D., D.Sc., F.A.S.B.

1921. The Hon'ble Sir Rajendra Nath Mukerjee, K.C.I.E.

1922. C. S. Middlemiss, Esq., C.I.E., F.R.S.

1923. Sir M. Visvesvaraya, Kt. C.I.E., L.C.E., M.I.C.E.

PREFACE

AMONG the cities that have hitherto been the places of meeting of the Indian Science Congress, Bangalore is the only one situated outside the frontiers of British India. Since it is also the centre of a tract of country relatively unfamiliar to the majority of visitors from north of the Deccan, it has been thought advisable to give in this Handbook information about some of the more interesting features of the Province of Mysore, rather than to confine the descriptive matter chiefly to Bangalore itself. It is, moreover, fitting that those who will attend the Eleventh Annual Meeting should be provided with the means of obtaining some slight acquaintance with the territory of His Highness the Maharaja of Mysore, who is at the same time Patron of the Meeting and Chancellor of the University at whose invitation the Congress meets in Bangalore on the present occasion.

These considerations, together with the necessity of keeping the volume within due limits, are responsible for the omission from the following pages of much that would be considered indispensable in an ordinary guide book. Little reference has been made (except in regard to education) to the Civil and Military Station of Bangalore, with its large garrison, its commercial activities, and its numerous public and private institutions, because these things are essentially the same as in other large garrison towns in British India. Those

who wish to know more of this important part of Bangalore can find detailed information in the Bangalore Brigade Area Official Directory.

Most of the articles in this Handbook have been contributed by persons whose intimate knowledge of the subjects on which they have written entitles them to speak with authority. For their liberal help the Compiler wishes to express his indebtedness on behalf of the members of the Congress. He has also to acknowledge the courtesy of the Government of Mysore in permitting him to reprint the articles on Mysore, Seringapatam, and Krishnarajasagara from the Handbook issued by them on the occasion of the visit of H.R.H. the Prince of Wales to the State ; and in placing at his disposal the blocks of four of the illustrations. The map of Bangalore, which accompanies the book, has been prepared in the Mysore Government Press.

Bangalore,
December, 1923.

F. L. USHER.

CONTENTS

MYSORE STATE

THE Mysore State is one of the largest of the Indian States in Southern India, with an area of 29,474 square miles and a population of six millions. It consists of an undulating tableland, much broken up by chains of rocky hills and scored by deep ravines, and is in the form of a triangle, with the apex to the south, at the point where the Western and Eastern Ghat ranges converge in the group of the Nilgiris. The general elevation rises from about 2,000 feet above sea-level along the north and south frontiers to about 3,000 feet at the central watershed, which separates the basin of the Krishna to the north from that of the Cauvery to the south. Isolated peaks of massive rock, called *durgs*, about 4,000 to 5,000 feet in height, form a prominent feature of the country, while chains of hills, running chiefly north and south, divide the tableland into numerous valleys. The majority of the population are Hindus, who form 92·62 per cent. Of the rest, 5·11 per cent. are Muhammadans, 0·69 per cent. are Christians, and 1·58 per cent. belong to other religions. Nearly three-fourths of the population are engaged in agriculture.

The City of Mysore is the capital of the State and the residence of His Highness the Maharaja. It is 2,525 feet above the level of the sea, and has an area of 9·50 square miles.

The State is noted for its picturesque scenery. It is naturally divided into two regions of distinct character: the hill country, called the Malnad, on the west; and the more open country in the east, known as the Maidan. The Malnad is a picturesque land of mountain and forest, presenting the most diversified and beautiful scenery. The famous Gersoppa Falls, where the river Sharavati precipitates itself down a chasm, 960 feet in

depth, are situated in the north-west, on the border of Mysore and the Bombay Presidency.

Mysore is rich in antiquities of various kinds, such as cromlechs, coins, buildings and inscriptions. Cromlechs are met with in large numbers in various parts of the State. Punch-marked coins, called *puranas* have been remarked at Nagar, Andhra ; lead coins and Chinese brass coins at Chitaldrug ; and Roman coins near Bangalore. Considering its area, Mysore is extremely rich in the number of its artistic structures, the majority of which are built in the Hoysala style, and the rest in the Dravidian style. The former came into existence during the rule of the Hoysalas, in the twelfth and thirteenth centuries, while the period of the latter ranges from the eighth to the sixteenth century. As regards inscriptions, though the survey is far from complete, the number of records that have been dealt with till now is nearly 15,000. These throw light on the history of Mysore from the days of Asoka, one of whose edicts is engraved in three places in the north-east corner of the State. The Andras, the Kadambas, the Gangas, the Chalukyas, the Rashtrakutas, the Cholas, the Sevunas, the Hoysalas and the Vijayanagar kings held sway successively in most cases in different parts of the State, before the present ruling family consolidated its power over the whole of Mysore. Among these, the Gangas and the Hoysalas were of local origin, and their sway extended over the greater part of Mysore and considerable areas of the surrounding territory. The dynasty of the Gangas held its own for nearly seven centuries, from about the fourth to the eleventh, and that of the Hoysalas for over two centuries from the twelfth to the fourteenth.

The origin of the present ruling family is ascribed to two Kshatriya princes of the Yadava race, named Vijaya and Krishna, who came from Dvaraka in Kathiawar to the south in 1399, and, being pleased with the country, took up their abode in the town of Mysore. Espousing the cause of a distressed maiden, the daughter of the chief of Hadinad, to the south-east of

Mysore, they saved her from a forced marriage with the chief of Karugahalli, who was of inferior caste, by secreting themselves at the wedding banquet and slaying him. She then became the willing bride of Vijaya, who assumed the government of Hadinad and Karugahalli. By the beginning of the seventeenth century the family became possessed of the tract of country immediately surrounding the town of Mysore. With the accession of Raja Odeyar the fortunes of the family became firmly established. He took possession of Seringapatam in 1610, ousting the Vijayanagar viceroy, Tirumala Raja, and made it his capital in place of Mysore. He also extended his territories towards the north and the south. The next noteworthy figure in the annals of the dynasty was the gallant Kanthirava Narasa Raja Odeyar, who extended and consolidated the territories of his family, and assumed all the insignia of royalty. It was, however, under Chikka Deva Raja Odeyar (1672-1704) that the kingdom attained its highest eminence. He acquired Bangalore in 1687, and even laid siege to Trichinopoly. He left to his successor a secure and prosperous kingdom, extending from the Plains and the Anamalis in the south to Midigesi in the north, and from the Baramahal in the east to the borders of Coorg and Balam in the west. But his successors were weak rulers. Internal dissensions, and aggressions of enemies from outside, paved the way for usurpation by a daring and capable Muhammadan adventurer in the person of Haider Ali, into whose hands the real sovereignty passed in the latter part of the eighteenth century. Under him and his son and successor, Tipu Sultan, the kingdom was extended in all directions and included a large part of the southern peninsula. On the fall of Seringapatam and the death of Tipu Sultan, in 1799, the British Government restored the State, comprised within its present limits, to the ancient Hindu dynasty in the person of Maharaja Sri Krishna Raja Odeyar Bahadur III. His grandson, the present Maharaja, His Highness Sri Krishna Raja Odeyar Bahadur IV, assumed direct control of the administration of the State in 1902, on his attaining majority.

Among the notable sights of Mysore are the superb specimens of Hoysala architecture, such as the temples at Halebid, Belur and Somnathpur, the colossal Jaina image of Gommatesvara at Sravana Belgola, the Gersoppa and Sivasamudram Falls, the extensive artificial lakes of Vanivilasasagara and Krishnarajasagara, and the hydro-electric works at Sivasamudram which supply electric power to Mysore, Bangalore and the gold mining industry at Kolar.

BANGALORE

Bangalore is the seat of government of the Mysore State, and headquarters of the Bangalore Brigade Area of the Indian Army. It covers an area of 25 square miles, and is composed of two separate but adjacent parts: Bangalore City, under the Mysore State, and the Civil and Military Station, a tract measuring nearly 14 square miles, assigned to the British Government and administered by the Hon'ble the Resident in Mysore. Bangalore has an elevation of about 3,000 feet above sea-level and is noted for its salubrious climate.

The place is of considerable antiquity, being mentioned in an inscription of about A.D. 900 at Begur, a village about eight miles to the south. The old records in the neighbourhood, such as the inscriptions at Dasarhalli (Bangalore 36, of about 750), Krishnarajapura (Bangalore 55, of about 750), Vartur (Bangalore 40, of about 820), Agara (Bangalore 79, of about 870), and Begur (Bangalore 83, of about 900), which refer themselves to the reigns of Sripurusha and other early Ganga kings, also testify to the antiquity of the tract. There is a story which ascribes the origin of the name of Bangalore to an incident in the life of the Hoysala king, Vira Ballala II (1173-1220). It states that the king, separated from his companions in a forest where he had gone to hunt, came upon a spot, faint and weary, where an old woman in a lonely hut had nothing better to offer him than a few boiled beans (*bengalu*

in Kannada) to appease his hunger, and that the town that grew round the spot became known as Bengaluuru, now corrupted into Bangalore. But as the name occurs, as stated before, nearly three hundred years before the time of Vira Ballala, the story has no foundation in fact. At each of the cardinal points of Bangalore City is an old watch-tower, which is said to mark the limits to which it was predicted the town would extend, a prediction which has now been more than fulfilled.

HISTORY

The Bangalore District formed a part of the Ganga Kingdom till the beginning of the eleventh century. In the eighth century Manyapura, now known as Manne, in the Nelamangala Taluk, was the capital of the Gangas. It was also the seat of the viceroys of the Rashtrakuta kings, who were in possession of the Ganga Kingdom for some time at the close of the eighth and the early part of the ninth century. Several ruined structures of architectural and artistic merit attest to the importance of the place at one time. The Cholas next held the district till about 1116. During their rule the district was named Vikramachola Mandalam. The Hoysalas followed, till 1336. In the thirteenth century, when the Hoysala territories were divided between Narasimha III and Ramanatha, the latter had the northern parts of the district included in his possessions. Under the Vijayanagar sovereigns certain Morasu Okkaligas from the east formed the states of Yelahanka, Devanhalli and Dodda Ballapur in the district. Kempe Gauda, a Yelahanka chief, erected a mud fort with the permission of Achyuta Raya, and made Bangalore his capital in 1537. He also built the four watch-towers, the Bull temple, the Gavi Gangadharesvara temple and the Kempambudhi tank, the last three situated about two miles to the south of Bangalore City. After the fall of Vijayanagar in 1565, Jagadeva Raya, the chief of Baramahal (Salem District), repelled the Musalman

attack on Penukonda in 1577, and was rewarded with territory in Mysore, his capital being fixed at Chennapatna in the Bangalore District. In 1638 Randulha Khan, the general of the Adil Shahi prince of Bijapur, captured Bangalore from Kempe Gauda and made it his chief residence, the Gauda retiring to his stronghold on Savandurga in the Magadi Taluk. In 1644 the district was given, with other neighbouring tracts, as a *Jagir* to the Bijapur general, Shahji, father of the celebrated Sivaji. He fixed his residence at first at Bangalore, but afterwards lived sometimes at Dodda Ballapur and sometimes at Kolar. On his death his son, Venkoji, continued to govern the *Jagir*, probably from Bangalore. An inscription at Mallesvaram, to the north of Bangalore, records that, on the application of the chief men of Bangalore, he granted in 1669 a village, situated about a mile to the east of Mallesvaram, to a Siva temple. Established on the throne of Tanjore on the death of Sivaji, Venkoji found his distant dominion of Bangalore to be an expensive and precarious possession. He therefore determined to sell it to the highest bidder, and Chikka Deva Raja Odeyar of Mysore agreed to purchase it for three lakhs of rupees. But before the negotiation was concluded, the Mughals over-ran the country and captured Bangalore. The imperial colours were, however, hoisted for only four days on the ramparts of Bangalore. For Khasim Khan, the Mughal general, resolved to accept the terms still offered by the Mysore king, as he would thereby obtain a large sum of money and escape the necessity of leaving a detachment to occupy the place. Thus this important town became a part of the Mysore Kingdom in 1687, and by the end of the seventeenth century the Mysore king gained possession of almost the whole district.

ARCHÆOLOGY

Cromlechs are found in almost all the taluks of the district. A good number of them have been explored, and ancient relics, in the shape of pottery, iron weapons

and bones have been unearthed. A find of Roman coins at Yesvantpur, about two miles to the north of Bangalore, in 1891, yielded silver denarii of the early emperors Augustus to Claudius. In the Bangalore fort are the Venkataramanasvami temple and the remains of Tipu Sultan's palace, and at some distance to the south of it the Bull temple and the Gavi Gangadhareśvara temple. In the Museum are kept several inscribed stones brought from different places in the district. One of them, a big stone elaborately sculptured with a battle scene, is worthy of notice. It is a *viragal*, or hero-stone, brought from Begur, about eight miles to the south of Bangalore, containing the inscription Bangalore 83, which records the death of the Ganga general, Nagattara, in a battle that took place about A.D. 900, between the Ganga king, Ereyappa, and the Nolamba king, Biramahendra. The inscriptions of the district have been published with translations.

OBJECTS OF HISTORICAL OR ARCHÆOLOGICAL INTEREST

The Fort. This is now practically a part of the City, and has no military value or purpose. The original Fort, which was of mud, was erected, as stated before, by the Yelahanka chief, Kempe Gauda, in 1537. Under its Hindu masters, namely, the Yelahanka chiefs, the Mahratta viceroys of Bijapur and the Mysore kings, the Fort retained its old character, with, no doubt, some additions to its strength. But under the Muhammadans the fortress was enlarged and rebuilt of stone. This work was carried out in 1761, the first year of Haider Ali's reign. The form of the Fort is oval, with round towers at proper intervals. At the time of its capture by the British, in 1791, it had five powerful cavaliers, a faussebray, a good ditch, and covered way without palisades, but the glacis was imperfect in some parts. The two gateways, one in the north and the other in the south, were called the Delhi and the Mysore gates respectively. The former was a handsome structure in

the best style of Muhammadan military architecture, and consisted of several gates surmounted by traverses. When the Fort was restored to Tipu at the peace of 1792 he dismantled it; but after 1799 Dewan Purnaiya had it completely restored on the former foundation. On the removal of the British garrison from Seringapatam in 1809, some of the troops had their quarters in the Fort, where the general commanding and many of the European residents also lived. When the arsenal, which had been transferred to it in about 1823, was given up, the military guards were withdrawn, and the Fort was handed over to the civil authorities in 1888.

The Dungeon. This is situated near the Delhi Gate of the Fort. It was here that Colonel (afterwards Sir David) Baird was confined in 1794, preparatory to exchange of prisoners with the British.

The Mahal, or Tipu's Palace. This, too, is in the Fort. A good specimen of Saracenic architecture, it was in the style of the Darya Daulat at Seringapatam. The building was of two storeys and not without some degree of magnificence. A large open space in front was surrounded by a corridor, in the centre of which, opposite the palace, was the *Naubat Khana*, or bandstand, in a gallery. The upper storey of the palace contained the public and private apartments of the Sultan and his ladies, with two balconies of state from which he gave audience. Paint and false gilding decorated the walls. From a Persian inscription in the palace (Bangalore 7) we learn that the building was begun in 1781, in the time of Haidar, and completed ten years after, in 1791, under Tipu. The inscription describes the building as a lofty mansion, as a home of happiness, as a house of glass in purity, and as a rival of the sky in magnificence, and states that when the painting of the palace was finished it cast the beauty of China into oblivion.

The Well in Front of the Palace. It is said that at this well Colonel Baird, when a prisoner, was made to draw water in order that the Sultan's ladies might see him.

The Venkataramanaswami Temple. This temple, in the

Fort, was caused to be erected by the Mysore king, Chikka Deva Raja Odeyar, in about 1700, as stated in the inscription (Bangalore 118). It has a fine *mukha mantapa*, or front hall, supported by ornamental pillars, and a lofty Garuda pillar in front.

The Watch-Towers. These are four in number, erected, as stated before, by Kempe Gauda in the four directions of Bangalore to indicate that the town he built would in course of time extend to those limits. They occupy conspicuous positions around Bangalore, and arrest the eye at once. One of them, on the east, stands on a rock on the Ulsoor tank bund; another, on the west, on the bund of the Kempambudhi tank; the third towards the north, near the Hebbal rifle range; and the fourth to the south, on a rock in the Lal Bagh.

The Cenotaph. This memorial, in the east of the City, was erected in memory of the officers and men who fell in the capture of Bangalore in 1791.

The Bull Temple. This is situated to the south of the Fort. The object of worship here is a huge bull in a recumbent posture, about 11 feet high, carved out of a boulder. An inscription on the pedestal (Bangalore 70) says that the feet of the bull are the source of the Vrishabhavati river, which runs to the west. This is an affluent of the Arkavati. This temple was founded by Kempe Gauda, as also the next.

The Gavi Gangadharesvara Temple. This, too, is situated to the south of the Fort, and is not very far from the Bull temple mentioned above. It is a cave temple dedicated to Siva. In the enclosure stand two stone umbrellas and two of the attributes of Siva, namely, a stone trident and a stone drum. Carved on a gigantic scale out of solid stone, these present curious specimens of the mason's art, each being about 12 feet high and proportionately wide. The temple was erected by Kempe Gauda.

The Lal Bagh. This beautiful pleasure garden, situated about a mile to the east of the Fort, appears to have been first laid out in the time of Haider and enlarged in the time of his son Tipu. In 1836 Sir Mark

Cubbon made it over to the Agri-Horticultural Society, which, on ceasing to exist in 1842, restored the garden to Government. In 1856 it was formed into a Horticultural Garden, and placed under the management of a professional superintendent. This system has continued to the present time, and the Lal Bagh has a wide-spread reputation.

R. NARASIMHACHAR.

THE ANTHROPOLOGY OF THE MYSORE STATE

LITTLE definite is known of the earliest inhabitants of the Mysore State. That Palæolithic man flourished in Mysore there seems hardly any doubt. Long after him came the people of the Neolithic Age, whose remains also have been traced in different parts of the State. The direct descendants of these people were probably the people of the Iron Age, who apparently were widely scattered over Mysore. In this Age stone implements were almost entirely displaced by iron ones, the art of iron smelting having been discovered. Wheel-made pottery also came into general use, and other metals, besides iron, began to be worked. The relation of these pre-historic races to the modern population of the State is, however, a difficult matter to discuss here. While some, Dalton among the earliest and Keane among the latest, have suggested that Palæolithic man is represented by the jungle tribes of Southern India, others would hold the question an open one until a pre-historic survey of a scientific kind yields us enough data to speculate in the matter. Between the Neolithic and Iron Ages no hiatus of time exists, the one following the other in quick succession; in fact, their civilisations overlap in the finds everywhere, except in burial places. The present inhabitants are apparently the direct descendants of the people of the Iron Age.

The population of modern Mysore is made up of at least three primary elements: (1) Pre-Dravidian, including the forest and hill tribes, under which head the Kadu Kurabas, the Kadu Gollas, the Soligaru, etc., of Mysore State fall. These form a section of the population entirely distinct from the Dravidians, who

form its main bulk; (2) Dravidian; and (3) Aryan. There has been much speculation as to who these pre-Dravidians are, and when and how they reached their present habitat. Similarly, in regard to the Dravidians, opinion is still divided as to whence they came and when. As regards the Aryans, their descent into the south and the extent of the influence they exerted on the people amidst whom they settled are still matters of keen discussion among the learned.

This three-fold division of the present population has been the result of a systematic anthropometric and ethnographic survey carried out in Southern India, including the Mysore State, during the past twenty years or so. This survey was inaugurated, at the request of leading anthropologists in Great Britain, by the Government of India in 1901, soon after the Census of India of that year. In accordance with the general plan then adopted, the survey was extended to Southern India, including the leading Indian States in it. The survey included not only a systematic inquiry into the ethnography of each of the major castes, but also a detailed examination, from an anthropometric point of view, of their physical characters. While the ethnographic portion of the survey was conducted by the late Mr. H. V. Nanjundaiya, C.I.E., the anthropometric part of it was carried out by Mr. Edgar Thurston, C.I.E., who was also responsible for similar work in the rest of Southern India. The defects arising out of a plurality of people undertaking work of this kind was thus avoided, and all possible accuracy was sought to be attained. Mr. Nanjundaiya's monographs have not been consolidated and issued as intended in the once projected volume of *Mysore Castes and Tribes*. This work should, it may be suggested here parenthetically, be undertaken without further delay, if all that has been done, at great cost and pains, is not to be permanently lost to future research students in the field of Mysore ethnography. As regards the anthropometric part, Mr. Thurston's results will be found incorporated in his monumental work, in seven volumes,

entitled *The Castes and Tribes of Southern India.* When the Mysore book comes to be finally issued, it would be a distinct advantage to get a separate chapter on its anthropometry written up for incorporation in its pages. This is neither the occasion nor the place to go into the general theories propounded, as a result of the survey above referred to, by Risley, Thurston and others, on the racial origins of the people of Southern India generally or the great institution of Caste with which they are closely connected. Nor is it possible here to examine even cursorily the criticism that has been passed on the results of the anthropometric surveys conducted by Mr. Thurston and Sir Herbert Risley. It is sufficient to say that further work is still deemed necessary if satisfactory conclusions are to be arrived at.

According to the Census of 1920, the total population of the State approximates to six millions. Among the many castes that go to make this number, the following, each numbering about 200,000 strong, may be described as the dominant ones in the State : Beda, Brahman, Holeya, Kuruba, Lingayat, Madiga and Vokkaliga. As regards distribution, Beda and Neygi are found in small numbers, and Bestha and Uppara very largely, in the Mysore District. Ganigara and Kumbara are found in small numbers in Chitaldrug District. Golla is found largely in Kolar, Tumkur and Chitaldrug Districts ; Madiga largely in Kolar, Tumkur and Bangalore Districts ; Holeya in comparatively small numbers in Shimoga and Chitaldrug Districts ; and Jogi largely in Bangalore and Kolar Districts. The Lingayat is found in comparatively small numbers in Kolar District. Lambanis and Nagarthas are to be found mainly in the Shimoga District. Mahrattas are found chiefly in the Bangalore and Shimoga Districts ; Naiyindas in the Bangalore, Mysore and Kolar Districts ; and Tigalas in Bangalore, Kolar and Tumkur Districts. The Vodda is found largely in Bangalore, Shimoga, Kolar and Chitaldrug. The other castes are found fairly evenly distributed over the State.

Systematic studies of several of the more important of these castes will be found by the interested reader in Mr. Nanjundaiya's monographs on them referred to above, and in the Mysore Census Reports for 1900 and 1910. In what follows, a brief idea is given of their general characteristics, noting any exceptional usages or customs followed by them. Though there is no evidence among any of the castes and tribes of Mysore of the general existence at some time in the past or now of polyandry, there is ample evidence of the prevalence of Mother Right traceable among several of them. The raising of children through the daughter, through the Basivi system, and the position generally assigned to the maternal uncle in the family, give us a glimpse of the days when the family centred round the mother and brother, and not her husband. Divorce is usually easy among most of the castes, while widow re-marriage is general. Among certain castes, a woman re-marries as many as seven times. Some traces of the levirate, the custom by which a widow is taken as the wife of the younger brother of her late husband, are also found in the State. The object of the levirate among the Jews was to provide a son for the deceased. Hindu law books refer to the practice called *Niyoga*, which, as a rule, was permitted only where the widow was childless, with the object of providing a son for the first husband. But this idea of raising offspring for the deceased is entirely absent, so far as can be gathered, from the only known instance, in the State, in which the younger brother is required to marry the elder brother's widow. This occurs among the Banjaras. According to the custom prevalent in this caste, the younger brother of the deceased husband is considered the most eligible person to marry a widow. This rule is carried so far as to sanction the marriage of a widow with a boy of tender years, with liberty to live with another person as substituted till he attains the proper age. She then rejoins him, bringing with her any children she may have meanwhile borne. Of late, however, this custom is being discredited, and a stranger is preferred to a brother-

in-law who is not of proper age. In such cases, the tali tied by the deceased husband, with the bride-price paid for her at the time of the second marriage, goes to the younger brother. When a widow marries her husband's younger brother no fresh bride-price is paid, which seems to indicate that the widow belongs not merely to her dead husband but also her husband's family This is in accordance with Gautama's well-known text: "People say the woman belongs to the husband's family, not to the husband alone." Among the Handi Jogis, though it is unusual for a widow to re-marry her late husband's younger brother, the caste does not object to his keeping her as his concubine. In such a case, the liaison is overlooked and the children are freely admitted as members of the caste. The evidence, scanty as it is, confirms the conclusion that, while the customs may sometimes have originated with the object of raising up seed to the deceased husband, it did not always do so. More often it seems to be a survival, as Sir Edward Gait suggests, speaking of cases of this kind, of fraternal polyandry, or at least of a state of society when the woman was regarded as a chattel bought with a price and at the disposal of her husband's heirs. Evidence of the general prevalence at one time of totemism among the castes and tribes of Mysore is fairly ample. It is now found in a decayed or decaying form among most of them. The subject is too large to go into here, but it might be remarked that it is well worth further study. The only genuine case of hypergamy in the State occurs among the Madigas. Among these, the Jambavas, the priestly section, do not give their daughters in marriage to men of lower status. Relics of marriage by capture are to be met with among the Bedars, Agasas, Nayindis, Idigas and Handi Jogis. Among the last of these, as the bridegroom and his party approach the bride's place, they are stopped by a party of the bride's relations who hold a rope across the path. After a mock struggle in which he is worsted, the bridegroom pays down a rupee to his opponents, who thereupon permit him to pass into the marriage booth. Among

the Banjaras, when the couple are led to the marriage booth, the bride puts up considerable resistance and is forcibly led to the place by an elderly woman. The couple then go round the milk post three times, the bride all the while weeping and howling. In the same manner, the couple pass round the second post three times, after which the elderly woman retires. The husband once again passes round the post with the bride. Her resistance is now redoubled, and he has almost to drag her by force. It is this which constitutes the binding or essential part of the ceremony in this caste. Adoption never appears to have been universal among the castes in the State. On the other hand, the perpetuation of the family in the daughter or daughter's line, or the affiliation of the son-in-law, seems to have been general.

Among unusual customs prevalent in the State may be mentioned a few. The existence of couvade among the Korachas is fairly well established. When a Koracha woman feels birthpangs, her husband puts on some of her clothes, makes the woman mark on his forehead, and retires to bed in a dark room. The practice exists in remote parts of the Shimoga District and elsewhere, and is reported to be dying out. The Myasa Bedas of Chitaldrug District practise circumcision. Whether they adopted this custom from the Muhammadans has still to be cleared up. But it is significant that the pig is taboo to them as an article of food. As the circumcision of women is not practised by them, it may perhaps be inferred that it has been borrowed by them. Customs of this kind, moreover, are never indigenously evolved. The Morasu Vokkaligas of Mysore had formerly a custom, now prohibited by Government, whereby a woman, before the ears of her eldest daughter were pierced prior to her betrothal, had to suffer amputation of the ring and the little fingers of her right hand. Among the Voddas, a man grows his beard until he is married, and removes it at the marriage time. Among the Kadu Gollas, a pregnant woman in labour is lodged far off from a village, and only a Beda

midwife is allowed to be near her. After three months the mother and child are brought in. Among the Banjaras, who profess to be descended from Brahmans, a Brahmana's presence is considered essential at the time of marriage. When one is not present an elderly man of the highest section of the caste, plays his part, putting on the sacred thread for the time being. When a Brahman is actually present, he is teased by women, young and old, in all sorts of ways. It is stated that the women feel keenly disappointed if they miss the fun with a Brahman, who is amply rewarded for his forbearance.

From the above brief sketch of Mysore castes and tribes, it will be seen how much there is of interest to be learned about them. More systematic work in this branch of scientific study is likely to yield results of far-reaching value.

What is required at present to further anthropological research in the State is, first, the publication in consolidated book form, without further delay, of Mr. Nanjundaiya's monographs, which have long been in the press, in order that what has been done, at great cost and labour, may not be altogether lost, both to the learned world and to the Government of Mysore. Now that Government can spare some money for work of this kind, it is to be hoped that they will be able to do something in the matter. Next, the State Archæological Department, now under the control of the University, should be so re-organised that pre-historic survey can get the attention it so richly deserves. A good scientific survey would yield much useful information. Then we should see if we could not, say through the aid of the Mythic Society, get a small grant for further research in the ethnographic and anthropometric fields. In these two branches of study much still requires to be done. As we have a local society which is quite alive to the needs of further research in these branches of study, the Mysore Government, who have shown so much practical sympathy with its aims and objects, can without any misgiving entrust it with this

work by making a small special annual grant for it. Arrangements of the kind indicated are likely to prove advantageous both to the Government and the society, and can hardly fail to commend themselves to all interested in anthropological study in Mysore.

C. HAYAVADANA RAO.

THE GEOLOGICAL HISTORY OF MYSORE[1]

THE geological formation of Mysore is confined, almost entirely, to the most ancient epoch in the history of the earth's crust of which we have any visible and tangible record. This epoch, which is known as the Archæan period, was long anterior to all the great sedimentary formations in which fossil records of the gradual evolution of plant and animal life have been preserved, and which are so extensively developed in Northern India and in other parts of the world.

The Schists. The Dharwar schists are largely composed of lava flows, associated igneous intrusions and their crushed representatives.

The base of the system is not visible, as it has been removed by the intrusion of the underlying granites and gneisses. On lithological grounds the system can be divided into a *lower* and an *upper* division without any perceptible break or unconformity between them. The lower division is composed essentially of dark hornblendic rocks—such as hornblende schist and epidiorite—which are probably metamorphosed basalts and diabases in the form of lava-flows, sills, etc., and very possibly some pyroclastic accumulations. The upper division is more varied and consists largely of rocks characterised by the presence of chlorite—such as greenstones and chlorite schists, and, less commonly, mica-chlorite schists and mica schists. Many of the greenstones still exhibit igneous characters and appear to pass insensibly into chlorite schists. In places the micaceous members also appear to grade into rocks of recognisably igneous character.

[1] This article is condensed from Bulletin No. 6 of the Department of Mines and Geology, Mysore State, written by Dr. W. F. Smeeth.

Taken as a whole, the Dharwar rocks afford evidence of very extensive igneous action, and many of the more schistose forms can be regarded as highly crushed and altered igneous rocks. Whether amongst the more schistose members there are rocks of sedimentary origin remains doubtful, as clear evidence is wanting, but it does not seem impossible that all of these rocks may have been derived from igneous material by metamorphic action.

Apart from these undoubtedly igneous types there are conglomerates, banded-ferruginous quartzites, quartzites and limestones, all of which would usually be regarded as indicative of sedimentary action.

Conglomerates. The more closely the conglomerates of Mysore are studied the less probable does their sedimentary origin appear to become. In many cases there is satisfactory evidence that they are crush-conglomerates formed in shear zones in the schists, or in one of the subsequent gneisses or in both. Other cases which have not been closely studied may still be open to question, but, on the whole, evidence favours the view that their origin is autoclastic and not sedimentary.

Banded Ferruginous Quartzites. The problem of the banded ferruginous quartzites presents much greater difficulty, owing largely to the fact that their contacts with other rocks are very obscure. Owing to their weather-resisting qualities the adjoining rocks are generally weathered, and generally also obscured by a talus of quartzite blocks. Contacts are therefore seldom observed, and when found are usually non-committal.

Quartzites. Passing now to the quartzites, some are practically all quartz, while some are felspathic and some micaceous. There is considerable doubt to what extent these can be regarded as the metamorphosed representatives of sedimentary sandstones. There is a great variety of types, and they appear to be of different ages. Many of the beds originally mapped as quartzite have proved on close examination to be altered and silicified quartz-porphyries, some of which retain enough of the porphyritic character to be recognisable. Others,

entirely quartzose, are occasionally found to exhibit intrusive contacts with adjoining rocks, while others of a later date penetrate the subsequent granitic gneiss and even pass from the gneiss into the schists.

There can be little doubt that many of these quartzites are crushed and recrystallized quartz-veins and quartz-porphyries, and possibly felsites, and it is at least open to question whether we have any which are genuine sedimentary rocks.

Limestones. Finally there are a number of beds or bands of limestone of dolomite, which ordinarily would be regarded as of aqueous origin. They are most numerous in the upper, chloritic division, and it may be noted that a large number of the greenstone and chlorite-schist beds are characterised by an abundant development of calcite, dolomite, or ferro-dolomite, not in the doubtful schistose members, but also in those which are only distinctly igneous. In addition, some of the gneissic granite bands associated with the schists develop calcite, which in places becomes extremely abundant.

To sum up—we have in the Dharwar System in Mysore a great series of lava-flows, sills, etc., and their crushed schistose representatives; associated with these are various doubtful schists which are more usually regarded as sedimentary, but which may possibly be igneous. There are also a number of subordinate bands or layers of more distinctly sedimentary habit, such as conglomerates, banded ironstones, quartzites and limestones, which are almost universally regarded as of sedimentary origin, but which are regarded in Mysore as probably formed from igneous material by metamorphic and metasomatic changes. In some cases there is strong evidence for this, but conclusive proofs are difficult to find, and many more instances will be required before such a proposition can be stated in general terms.

Ultrabasic Intrusives. Passing now from these components of the Dharwar System, we come next to a series of rocks which may be classed as ultra-basic. These consist of amphibolites—often in the form of

actinolite or tremolite schists—amphibole-peridotites, peridotites and dunites with their alteration products, potstone, serpentine and magnesite. They appear to be sills, dykes and intrusive bosses in the mass of the schists, and are regarded as belonging to the Dharwar System on account of the evidence of their having been cut off and broken up by the subsequent intrusive peninsular gneiss. They are of importance for their mineral contents, and contain considerable deposits of iron ore, chrome ore and magnesite.

Other Intrusives. Finally, we have some large intrusive masses of gneiss (Champion Gneiss) and some basic rocks, diabasic or dioritic in character, which appear to be later than many of the rocks already mentioned, but prior to the peninsular gneiss, and so regarded as of Dharwar age.

Champion Gneiss. The Champion Gneiss is a comparatively fine-grained micaceous gneiss with bands and veins of coarser granite, pegmatite and quartz. It is usually highly crushed, and frequently contains zones of conglomerate composed not only of round to subangular fragments of the various granitic materials, but also patches and lumps of the other adjacent Dharwar rocks, including the banded ferruginous quartzites. This gneiss was first recognised as a wide band near the eastern edge of the Kolar hornblendic schists, into which it intrudes in tongues. Some distance south of the Mysore mine, the gneiss extends across the strike of the schists and then continues southwards near the western edge of the schist belt. From south of the Mysore mines it sends some tongues northwards into the schists, which are soon lost on surface, but some of them have been recognised in the deeper workings of the Mysore mine a mile or so to the north of the outcrops. The gneiss is often characterised by the presence of grains or blebs of opalescent quartz, the colour varying from a slight bluish milkiness to brown or dark grey, and has been referred to as *opalescent-quartz gneiss*. As a less cumbersome name, and on account of its intimate and probably genetic connection with the auriferous

veins of the Champion *lode* of the Kolar Gold Field, it is named the *Champion gneiss.* Other patches and runs of what is believed to be the same gneiss have been recognised more recently in the schist belts occurring in the Shimoga, Chitaldrug and Kadur Districts, and are described as felspathic grits, argillites and mica schists in the records of the Mysore Geological Department.

The Champion gneiss represents a very early period of granitic intrusion into the schists. Many of the highly crushed quartz-porphyries or fine granite-porphyries which have been alluded to as occurring in bands among the schists also contain similar opalescent quartz-blebs or phenocrysts, and may very possibly be genetically connected with this early Champion gneiss.

The remnants of the latter are not very extensive, and there is evidence of their having been intruded and cut off by the next succeeding formation, which is the great gneissic complex of Mysore and probably of Southern India as a whole.

At the close of the Dharwar age, the whole of Southern India was covered with a mantle of these Dharwar rocks several thousand feet in thickness, but successive intrusions of granite from below gradually penetrated, or ate into, the over-lying mantle, and this, combined with folding and faulting, caused the lower surface of the mantle in contact with the granites to become a very uneven one. Subsequent denudation for many millions of years removed the greater portion of the mantle of Dharwars, with the result that we now see the underlying granite and granitic gneisses exposed at the surface. The comparatively narrow strips of the Dharwar rocks which still remain are but the deeper fragments of the once thick, continuous layer.

Distribution of the Schists Belts. The total area of the Dharwar rocks in Mysore is nearly 5,000 square miles, representing approximately one-sixth of the area of the whole State, and is distributed mainly as follows:

1. *Kolar Schist Belt.* Situated near the eastern side of the State in the Kolar District. It extends north and south for about 40 miles, with a maximum width of four miles, the total area being about 100 square miles.

It is composed entirely of the dark hornblendic rocks of the *lower* division of the Dharwar schists, with some banded ferruginous quartzites close to its eastern and western edges, and some bands of amphibolite, some of which are intrusive.

The Kolar Gold Field is contained within a length of five miles towards the southern end, and the workings are now approaching a vertical depth of one mile below surface.

Indications of gold have been found further north at various points, but successful working has not yet been established.

2. *Chitaldrug Schist Belt.* This runs through the middle of the State with a north-north-west trend in the Chitaldrug District, where it has a maximum width of 25 miles, and passes southwards through the Tumkur and Mysore Districts, in which it becomes split up into narrow bands, finally disappearing a few miles south of Seringapatam. The belt extends north of the State into the Bombay Presidency, the total length in Mysore being about 170 miles and the area nearly 2,000 square miles.

The main portion of the belt is composed of chloritic schists of the *upper* division, felspathic grits and mica schists, but at the sides and in some of the narrower bands in the Mysore District there are considerable masses of the dark hornblendic schists. Numerous bands of ferruginous quartzite occur throughout the belt, and quartzites are abundant in places. Towards the western side, in the Chitaldrug and Tumkur Districts, are numerous bands of limestone—chiefly magnesian—and numerous bands and patches of iron and manganese ores. The iron ores are mostly soft hæmatites and limonites, and the manganese ores are mostly highly ferruginous.

3. Sundry small bands and patches of the older hornblendic schists occur in the Hassan District, and are noticeable chiefly for the number of sills, dykes or intrusive masses of amphibolite and peridotite, with which are associated iron and chrome ores and magnesite. The better classes of chrome ore and magnesite occur further south, in small patches of peridotite and dunite, in the Mysore District.

4. *Shimoga Schist Belt.* This occupies a large part of the Kadur and Shimoga Districts, and extends northwards through the Dharwar District of the Bombay Presidency. In Mysore it is broken up into a number of large irregular patches separated by the later granites and gneisses, the total schist area being between 2,500 and 3,000 square miles. The dark hornblendic schists occur chiefly along the Western ghats and around the Bababudan hills, while the areas around Ubrani, Koppa, Kumsi and Shikarpur consist very largely of chlorite schists, greenstones with some mica schists, grits and autoclastic conglomerates.

Quartzites of various kinds are abundant and very noticeable, and numerous bands of magnesian limestone occur in the Ubrani, Channagiri and Kumsi schists. Banded ferruginous quartzites are abundant, and large quantities of hæmatite and limonite occur along the eastern hills of the Bababudan chain. Gold is widely distributed, but the lenses, or veins of ore, though often rich, are small and lack continuity, and successful mining has not been established.

Manganese ores are widely distributed in the chloritic schists, but many of the deposits are small. Some of the deposits, however, are of considerable extent.

The ore is of fairly high quality, and there are also very large quantities of more highly ferruginous ores which cannot be exported or utilized at present.

5. In addition to the above, small shreds, patches, and fragments of the various schists—chiefly those of the lower hornblendic division—are widely scattered throughout the later intrusive gneisses and granites.

GRANITES AND GNEISSES

With this brief notice of the Dharwar System, we may pass on to the subsequent granites and gneisses which now occupy by far the greater part of the whole area.

Until recently, the gneissic complex has usually been regarded as the oldest formation of peninsular India, and the term "fundamental," which has been freely applied to it, has usually carried with it the idea that it is the basement rock on which all the others—including the Dharwars—have been laid down. Detailed work over the greater portion of Mysore has shown that this is not the case, and that this great gneissic complex is everywhere intrusive into the rocks of the Dharwar System. It seems desirable, therefore, to avoid the use of the word "fundamental," and as the complex is probably the most extensive formation of peninsular India it has been styled the "*Peninsular gneiss.*"

Peninsular Gneiss. This peninsular gneiss, which underlies and intrudes the Dharwar System, is a complex of various granites, but so protean that no adequate description can be given here. It is the most extensive and widely distributed rock in the State, and is used largely for building and structural purposes. The various granites, of which three are often distinctly recognisable, give evidence of successive intrusion, and the fact that the earlier forms contain their own pegmatites, which are truncated by subsequent forms, points to a long continued period of plutonic activity. Frequently, the various members mingle either by repeated injection or absorption or crushing and shearing, and we get zones or areas which are highly banded or crushed or with complex flow structure. Other portions are more homogeneous and appear as granite masses. Amongst these latter are some which may be definitely later in age than the gneiss as a whole, but it is often difficult to decide one way or the other.

Evidence of the intrusion of the peninsular gneiss into the Dharwar rocks is abundant, and the former bristles, to a variable extent, with the caught up lenses, patches, and fragments of the latter.

Charnockite. The next formation is itself highly complex, but, thanks to the genius of Sir Thomas Holland, it can be recorded and summarily dismissed with the name Charnockite.[1] It is a huge plutonic complex, characterised chiefly by the presence of hypersthene, in which the alternating bands, frequently steeply inclined, vary from an acid hypersthene-granite through various intermediate forms to hypersthene-norites and hypersthenites. These rocks form the great mass of the Nilgiris to the south of Mysore, and come into Mysore on its eastern, southern and western borders, where they are found distinctly penetrating the peninsular gneiss, both as tongues and as basic dykes. An interesting addition to the series has been indentified in Mysore in the form of dykes or narrow intrusive tongues of quartz-magnetite ore. Gradational forms have been found in which the proportions of magnetite and quartz gradually increase, with corresponding elimination of felspar, hypersthene and amphibole, until we get to a rock containing 50 per cent. of magnetite, the remainder being quartz with subsidiary amounts of hypersthene and garnet.

Closepet Granite. The last formation of any considerable magnitude is the Closepet granite. It occurs as a band about 20 miles in width, running right through the Province in a north and south direction, from the southern boundary on the Cauvery river near Sivasamudram to Molakalmuru in the extreme north of Chitaldrug, a distance of over 200 miles. Doubtless it extends much further, both north and south, into British territory. Topographically it is usually striking, as it forms a great chain of rounded bosses or domes, many of which are bare rock and form conspicuous features, amongst which may be mentioned the Closepet hills, Magadi, Shivaganga, Devarayadurga, and the continuation of the chain northwards through the Tumkur and Chitaldrug Districts. Like most of the plutonics of Southern India, it also is complex and is composed of a mixture of red and

[1] *Mem., Geol. Survey of India*, XXVIII, pt-2 (1900).

grey granites, sometimes coarse, sometimes porphyritic, and sometimes so intermingled or deformed as to become gneiss. It intrudes all the previously mentioned formations, including the Charnockite. It is probable that other isolated masses in Mysore—for instance, Chamundi Hill and the Arsikere and Banavar masses—may belong to the same age, and it is possible that the ornamental porphyry dykes of Seringapatam may be phases of this intrusion.

This completes the distinct members of the Archæan complex which have been definitely recognised in Mysore—with the exception of various hornblendic and other basic dykes.

Dykes. Subsequent to the formation and folding of the Archæan complex, the whole country has been traversed by a series of basic dykes—chiefly dolerites—which from their freshness and the absence of deformation are regarded as post-Archæan, and it has been suggested that they may be of Cuddapah age.

Laterite. The only other rock formation in Mysore is laterite, which is of comparatively recent (possibly Tertiary) formation, and forms a horizontal capping in places on the upturned edges of the much-denuded Archæans.

FAUNA OF MYSORE

THE plateau of Mysore, surrounded practically on three sides by mountain ranges, is diversified by certain well-defined physical characteristics. The *malnad* tract, which includes Shimoga, Kadur, and Hassan Districts, is an undulating country with open valleys covered with heavy forests, and hills which here and there rise into bare crags in the higher altitudes. The level plains, which constitute the greater part of the *maidan*, derive their character from the means of water supply and the soil determining the cultivation. The fauna of the country lying west of a line drawn roughly from Shikaripur to Periyapatna, which fairly comprises the *malnad*, is in richness and variety comparable with that most diversified wealth of animal life met with in Malabar and Travancore. In fact, the Western Ghats and the parallel ranges in South Canara and Mysore harbour practically all the animal life that is of interest to the sportsman and the scientist in South India.

The monkeys occurring in Mysore belong to the two genera *Macaca* and *Pithecus*, and number about half-a-dozen species. The lion-tailed and the bonnet-monkeys (*M. ferox*, Schr. and *M. sinica*, Linn.) affect dense jungles; the former is a perfect savage; the latter, also found near populous towns and villages, is a great robber. The langurs and Hanuman monkeys (*P. entellus anchises*, Blyth; *P. priam*, Blyth; *P. hypoleucos*, Blyth) occur in the far-off groves near villages and streams. The Mysore lemurs (*Loris lydekkerianus*, Cabr.) may be captured in numbers at Bangalore, but seldom thrive in captivity. They resemble the spotted owl (*Athene brama*, Tenm.) both in appearance and cry.

Of the cats, the panther rather than the tiger comes frequently into collision with man in Mysore, since it

lives in close vicinity to his habitations in the country parts; the black variety occurs near the forest belt (Gundlepet) separating the Wynaad from Mysore. In the Mysore menagerie the black and ordinary forms of panthers were confined in the same cage, to induce cross breeding, but with what results few know. The leopard cat (*Felis bengalensis*, Kerr.) and the common jungle cat (*F. affinis*, Gray) are met with in the malnad, and are very destructive to poultry. The detached woods and copses all over the country form the favourite haunts of the Mysore civet cat (*Viverricula malaccensis*, Gmel.), the toddy cat (*Paradoxurus niger*, Cuv.), and the mongoose (*Mongos mongo mungo*, Gmel.). The last-named, of which there are three species, are common in hedgerows, thickets, and cultivated fields, where they breed from June to September. The hyænas and dogs (*Canis naria*, Wroughton; *C. indicus*, Hodgs; *Cuon dukhunensis*, Sykes; *Vulpes bengalensis*, Shaw) are extremely common in malnad areas; and the jackal and fox, extending into the plain country, sometimes prove a pest to coffee, sugarcane, and ground-nut cultivation. The South Indian marten (*Martes gwatkinsi*, Horsf.) occurs, like the otter (*Lutra lutra*, Linn.), in the neighbourhood of streams and rivers flowing through hills in Shimoga, Kadur, and Mysore, and are destructive to mahseer. The South Indian hedgehog must be looked for in places adjoining Coimbatore and the Nilgiris; while the shrews (*Pachyura murina*, Linn.; *P. cærulea*, Kerr.) inhabit woods and frequently appear in human habitations. The Indian fruit bat (*Pteropus giganteus giganteus*, Brunn.) is a common sight on the Mysore road, and the other members, the fulvous fruit bat (*Rousettus leschinaulti*, Desm.), a cave-haunting form, together with the short-nosed fruit bat (*Cynopterus sphinx*, Vahl.), are destructive to fruit gardens. The family Rhinolophidæ, distinguished by a nose leaf, is represented by about half-a-dozen species of *Rhinolophus* and *Hipposiderus*, occurring both in the forests and human dwellings. The large vampire bat (*Lyroderma lyra lyra*, Goeff.) frequents houses, where the

spoils of its foraging expeditions may be found on the verandah every morning. But the great majority of our bats belong to the family Vespertilionidæ, distinguished by the occurrence of a tragus in the ear and by the absence of a nose leaf. The Pipistrellæ frequently enter lighted rooms, where they fly about in quest of insects, chiefly winged termites. More than one member of the painted bats (*Kerevoula picta*, Cantor; *K. crypta*, Wroughton) may be captured in plantain gardens; while the Indian mouse-tailed bat (*Rhinopoma hardwickii*, Gray) has been reported from the State. The flying squirrels, the striped squirrels (*Funambulus*), the giant squirrels (*Ratufa*), and the grizzled squirrel are found both in the maidan and malnad, where they carry on their depredations without let or hindrance. The tree gnawers (*Muridæ*), and the rats and mice (*Cremnomys*, *Platacanthomys*, *Bandicota*, *Gunomys*, *Vandeleuria*, *Epimys*, *Rattus*, *Mus*, *Leggada*), of which there is a considerable number in Mysore, are a nuisance to all save the zoologist in his professional capacity. The Indian porcupine (*Hystrix leuca*, Sykes) is found near coffee plantations, as well as in sugarcane, groundnut and potato areas. The hares (*Lepus ruficaudatus*) affect waste ground or dry cultivation.

The movements of elephant herds are practically confined to the Districts of Mysore, Kadur and Shimoga, where the gaur, or bison (*Bibos gaurus*, H. Sm.), also occurs. Blanford reports the occurrence of nilgai, the blue bull (*Boselaphus tragocamelus*, Pall.), but not the Indian ibex (*Capra warryato*, Gray), in Mysore. The antelope (*Tetracerus*), the gazelle, or ravine deer (*Gazelle bennetti*, Sykes), the deer-like muntjack (*Muntiacus vaginalis*, Bodd.), the sambar, or rusa deer (*Rusa unicolor*, Bechs), and the spotted deer (*Axis axis*, Erx.), are among the sportsman's favourites. The Indian pangolin (*Mamis crassicaudata*, Goeff.) is common all over the State.

The avifauna of certain tracts in Mysore, such as the Bhadra valley in Kadur, is abundant and varied, and the occurrence of a large supply of insect and vegetable

food all along the Western portions of the State is responsible for an exceptional wealth of bird life. The order Passeres, which includes nearly half the total number of the known species of birds, is represented in Mysore by the crows (*Corvus*), the tree magpies (*Pica, Urocissa*), the tits (*Parus, Machlolophus*), the laughing thrushes (*Garrulax*), the babblers (*Argya*), the whistling thrushes (*Myiophoneus*), the bulbuls (*Hypsipetes*, etc.), the nut-hatches (*Sitta*), the drongo-shrike (*Dicurus*), the warblers (*Acrocephalus*), the tailor-bird (*Orthotomus*), the shrikes, or butcher-birds (*Lanius*), the starling (*Pastor*), the mynas (*Acridotheres*), the fly catchers (*Cyornis, Stoparola*), the weaver birds (*Ploceus*), the munias (*Sporæginteus*), the yellow throated sparrow (*Gymnornis*), the rose finch (*Caropodacus*), the martin (*Chelidon*), the swallow (*Hirundo*), the wagtails (*Motacilla*), and the skylark (*Miratra*). A list of the species would occupy several pages. A great many of these are temporary visitors; the corn-feeders appear in large numbers about the harvest time, while the insect catchers visit us after or during the wet weather. The familiar genera of woodpeckers (order Pici) are *Tiga*, which breed in Bangalore about March, while the common barbets (order Zygodactyla, Therciceryx) and the familiar coppersmith (*Xantholpema*) select June and July for breeding. The hornbills (Bucerotidæ) are confined to the malnad belt, while the kingfishers (*Ceryle, Alcedo, Halcyon*) are common near all tanks and rivers. There are five species of swifts in Mysore belonging to Cypselus, and a few species of nightjars (*Caprimulgus*), whose eggs may be found in the malnad on the bare ground. The members of the sub-family Cuculinæ (*Cuculus, Hierococcyx, Eudynamis, Cocomantis*) visit Mysore between March and July. Specimens of the Indian loriquet (*Loriculus vernalis*, Sparrm.) are cold weather visitors of our gardens, while its congener *Palæornis* is a permanent resident. Little is known about the Striges; the most familiar member is the little semi-diurnal spotted owlet (*Athene brama*, Tenm.), to be seen perching on the

electric wires in Bangalore ; and *Strix flammea* Linn., the barn owl so greatly dreaded by the Hindus. The diurnal birds of prey include the vultures (*Neophron*), scavenger vulture (*Otogyps*), and the great body of raptorial birds, comprising the hawks, kites, falcons, harriers and eagles. The South Indian green pigeon (*Crocopus chlorogaster*, Blyth), like the grey-fronted green pigeon (*Osmotreron affinis*, Jerd.), occurs wherever the banyan and the peepul trees abound. Of the doves, the spotted species (*Turtur suratensis*, Gmel.) is reported from Mysore. The Gallinæ are represented by the pea fowl (*Pavo*), the jungle fowl (*Gallus sonnerati*, Tenm.), and the bush quails and grey quails (*Perdicula*, *Coturnix*) living habitually near bamboo bushes ; while the white-painted partridge (*Francolinus*) affects cultivated tracts. The other orders, like Grallæ, Liuricolæ, Gaviæ, Steganopodes, Herodiones, and Anseres are represented by certain rails, florican, the stone plover, "snippets," the snake bird, the river tern, storks and nuktas. The common snipe, which visits Mysore in the cold weather, is *Gallinago stenura*, Kuhl.

Among the reptiles, the mugger (*Crocodilus palustris*, Less.) abounds at Seringapatam and Benkipur, where chelonians, like the soft-shelled family Trionyx, also occur. The terrestrial forms, *Testudo elegans*, Schep., and *Nicora trijuga*, Schweigg., are fairly common, as are also lizards (*Gymnodactylus*, *Gonotodes*, *Hemidactylus*, *Sitana*, *Slea*, *Calotes*, *Carassia*) and the monitor (*Varanus*). Skinks (*Lygosoma*, *Mabuia*) and chamæleons are as plentiful as the snakes, almost every family of the latter being well represented. The limbless amphibians are confined to the moist hill forests near the Wynaad, while the groups Ranidæ, Bufonidæ and Engystomatidæ are found fairly abundantly all over the State.

The river Cauvery with its principal affluents, the Lokapavani, Shimsha, Arkavati, Lakshmanatirtha, and Kabini ; the Thunga, Bhadra, and the Sharavathi with its numerous mountain streams, as well as some of the

great artificial lakes, abound in excellent fish ; the orders Physostomi and Acanthopterygii provide many specimens for sport, science and the market.

Very little is known about the invertebrate fauna of the State, and the immense forest belt, and the wide bodies of water included in them, must harbour many forms still unknown to science.

C. R. NARAYANA RAO.

BOTANY

THE Botany of the Mysore Province includes the Flora, *i.e.* the flowering plants, ferns, mosses, liverworts, algæ and fungi in their native surroundings; and the plants of horticultural and agricultural importance which are either indigenous or imported.

The Mysore plateau, although within the tropics, owing to its elevation has a cool climate, and its varied rainfall, from nearly 300 inches to as little as 20 inches, determines the enormous variation in its flora.

I. The Forest Flora. An ordinary traveller who keeps to the railways sees very little of the magnificent forests of Mysore, except in a few cases where there are scrub jungles near the railway lines. These large forests are found on the western side of the Province, and may be reached by travelling fifty or sixty miles from the nearest railway station.

The forests of Mysore can be divided into three more or less distinct belts, running from north to south. Starting from the extreme west there are:

(i) *The Evergreen Belt.* Stretching along the Western Ghat slopes, with a width varying from 6 to 40 miles, from about the north of Sorab to the south of Manjarabad.

(ii) *The Deciduous Belt.* This is at present the most valuable timber tract, and lies to the east of the above, and extends more or less continuously from the north of Shikarpur to Chamarajanagar, varying from 20 to 30 miles in width.

(iii) *Dry Deciduous Fuel Tract and Scrub.* This lies to the east of the central watershed of the State, and runs north to south in two narrow strips. Each of these types of forest may be again differentiated into two kinds:

(*a*) *The Moist Evergreen Belt.* The moist evergreen forest stretches in a narrow strip along the Western Ghats for over 225 miles, from the Jog Falls in the Sagar Taluk to Bisale Ghat in Manjarabad. The approximate area of the forest is 1,000 square miles. The tract is mountainous, with deep ravines and narrow valleys. Bare grassy ridges, with richly-wooded valley slopes, are the characteristics of parts of this belt. The hill-tops are covered with plants of a herbaceous nature, which are similar to the plants of temperate climates. There are several ground orchids, of which *Habenaria longicalcaria* has a spur of nearly six inches in length In the neighbourhood of mountain streams there are such delicate plants as *Elatostema* and Balsams, also *Trichomenes* and a few mosses Except on the margin of the forest, where the ubiquitous Strobilanthus flowers, seeds profusely and dies, there is little herbaceous undergrowth within the forest. Owing to the heavy rainfall, which is as high as 250 inches, all the dead leaves within the forests are washed away during the rainy season, which extends from early June to the end of October. In these forests there are lofty climbers, like *Gnetum Scandens* and *Entada Scandens*. Near the water courses the tree ferns, *Alsophila* and *Angiopteris*, may also be seen. The grassy hill-tops are usually burnt down during the early part of the year. In slowly running streams, in cool and shady places, there are species of the Red Alga, *Batrachospermum*, and in rapidly flowing waters species of *Podostemaceæ* may be found adhering to the rocks. There are several species of the liver worts, like *Anthoceros*, *Notothylos*, *Aneura*, *Pallavecenia*, etc., and in cool places *Selaginellas* also. Several genera of Phalloids, such as *Simblum*, *Colus*, *Clathrus*, *Aseroe* and *Dictyophora*, have been collected by Mr. M. J. Narasimhan, of the Department of Agriculture, in the areca gardens during the rainy seasons. The typical species of trees found in this area are: *Poeciloneuron indicum*, *Calophyllum inophyllum*, *Dipterocarpus indicus*, *Hardwickia pinnata*, *Elæocarpus*, Spp., *Mimusops elengi*. *Mesua ferrea*. ironwood tree, *Dichopsis*

elliptica, *Cinnamomum zeylanicum*, *Garcinia indica*, *Myristica magnifica*, *Bischofia javanica*, *Diospyros*, Spp. *Hopea parviflora* is found in some places over extensive areas. *Dysoxylum malabaricum* and *Evodia roxburghiana* are found in small numbers. *Lagerstroemia lanceolata* and *Artocarpus hirsuta* are met with occasionally.

Mixed Belt of Evergreen and Deciduous Forests. This is a broader strip of forest, about 30 miles wide, and extends from the north of Sorab to the south of Manjarabad, through Sagar, Nagar, Tirthahalli, Narasimharajapura, Koppa, Mudagere and Belur Taluks. Except for numerous villages and hamlets, large paddy and areca nut tracts, and extensive clearings in the hills for leaf manure, this belt forms one rich stretch of forest, with many valuable timber species. The rainfall is from 60 to 100 inches, or a little more. The herbaceous vegetation is best seen during the monsoon times, and closely resembles the plants of the real tropical rain forests. There are several species of epiphytic orchids and ferns, and the telegraphic plant, *Desmodium gyrans*, can be seen by the road side. Species of *Lygodium* and *Osmunda regalia* (Royal fern) can be seen near the streams. The principal species of trees found growing are :

Terminalia paniculata, *Terminalia tomentosa*, *Lagerstræmia lanceolata*, *Eugenia jambolana*, *Xylia dolabriformis*, *Cedrela toona*, *Chickrassia tabularis*, *Artocarpus hirsuta*, *Hopea wightiana*, *Vitex altissima*, *Holigarna arnottiana*. *Cinnamomum zeylanicum* and *Garcinia indica* and other species are found only in the shady valleys or ravines, called kans. *Bambusa arundinacea* is the predominating feature of this tract. Occasionally *Shorea talura* is found. Sandal is particularly abundant in this region, but the perfume of wood grown in this locality is not so strong as of that grown in more arid parts, especially where the soil is red and stony. It will thrive among rocks where the soil is good, and in such places, though it is small in stature, it is generally richer in oil. The bark and sapwood

have no smell, but the heartwood and roots are highly scented and rich in oil. The girth of a mature tree varies according to circumstances, from 18 to 36, or, in exceptional cases, 40 inches. It attains maturity in about 50 years. The older the tree, the nearer the heartwood approaches the surface; while the bark becomes deeply wrinkled, is red underneath, and frequently bursts, disclosing in old specimens the absence of all sapwood. In colour and marking, four varieties of wood are distinguished, *i.e.* white, red, cobra and peacock colour. The two latter command fancy prices. The heartwood is hard and heavy, weighing about 61 lbs. per cubic foot.

Deciduous Teak High Forest Belt. The last-named tract gradually merges into this forest belt in Shimoga and Kadur Districts and along the frontier in Mysore District, and extends from Shikarpur to the extreme end of Chamarajanagar, with a small interruption in Hassan. The average annual rainfall over this portion is from 60 to 45 inches. This is the most valuable strip of high teak forests in the State, and is about 647 square miles in extent. The most important species is teak; its valuable associates are the following:

Dalbergia latifolia, *Terminalia tomentosa*, *Pterocarpus marsupium*, *Grewia tiliæfolia*, *Anogeissus latifolia*, *Adina cordifolia*. Other deciduous species, like *Garuga pinnata*, *Bombax malabaricum*, *Schleichera trijuga*, *Stephegyne parvifolia*, *Kydia calycina*, *Phyllanthus emblica*, *Gmelina arborea*, etc., make up the rest of the forest, with heavy small bamboo growth over hill slopes and undulating country, big bamboos being confined to channels and streams.

The principal species attain a considerable size: *Tectona grandis*, *Adina cordifolia*, and the Gum-kino tree, ranging in girth from 10 to 15 feet, and Matti and other species, of girth varying from 8 to 12 feet, are very common.

In the outskirts of this belt of forest there are well-populated villages, and the forests themselves are made easy of access, with convenient fair weather roads

equipped with well-designed and comfortable inspection lodges, staff and labour quarters.

Deciduous Teak Pole Belt. This strip of forest, which extends from Anavatti in Sorab to Chamarajanagar, is similar in composition to the above, but the growth is very poor, the trees not attaining a girth of more than about four feet anywhere. The average rainfall varies from 30 to 35 inches, and the crop is open with an undergrowth of grass. The forest yields small timber. The total area of this type of forest is about 262 square miles. The major portion of this belt of forest has all conveniences in the matter of roads and labour.

The sandal tree is largely grown in this area, and though the tree does not attain a very large size, the yield of oil is very good. The tree is badly attacked by the spike disease, which is causing a great loss to the revenue of the State. It has been estimated that annual losses from this disease amount to between five and six lakhs of rupees.

A considerable amount of scientific investigation of this disease has been carried out, more especially by the Mysore Agricultural Department, while forest officers in Mysore, Madras, and Coorg have studied it extensively in the field. Although the disease has been definitely proved to be infectious, the cause has not been discovered. The work of investigation is being organized, and the appointment of a special scientific officer to aid in this work has been sanctioned by Government.

A reward of Rs 10,000 has also been offered by the Government to anyone who discovers the cause of the spike disease and suggests an effective, cheap and easily applicable remedy for its eradication.

Dry Deciduous Fuel Forest. This may also be divided into two definite strips of forest on account of certain characteristic differences.

Superior Type of Fuel Forest. This strip, starting from about the south-western limits of Davangere Taluk, extends to the north of Channapatna. Towards the east it extends to the provincial boundary of the

State in Bangalore and Kolar Districts. The average rainfall over this tract varies from 25 to 30 inches. The herbaceous vegetation during the rainy season consists of a few grasses and sedges, and also some perennial types, like *Andrographis serpiliphylla* and *Lepidagathis indicus*, etc. The shrubby vegetation consists of several kinds of thorny plants, like *Canthium*, *Barleria* and *Flacourtia*. There are occasional growths of *Phoenix sylvestris*, of a gregarious habit, and *Cycas circinalis* is also found wild in this region. The chief bamboos are *Bambusa arundinacea* and *Dendrocalamus strictus*. *Commelinaceae* and species of the Labiate genus *Leucas* are very abundant. *Orchideae* are represented by *Habenaria platiphylla*, while *Scitamineae* are very rare. Except for two species that may be found in slightly protected parts, ferns are absent. Parasites *Cuscuta* and *Cassytta* are commonly seen.

The principal species of trees to be found are *Acacia catechu*, *Erythroxylon monogynum*, *Albizzia amara*, *Lagerstroemia parviflora*, *Anogeissus latifolia*, *Shorea talura*, *Terminalia paniculata*, *Acacia ferruginea*, *Acacia arabica*, *Acacia leucophloea*, *Dalbergia paniculata*, *Diospyros tupru*, *Premna tomentosa*, *Acacia* Spp. and *Zizyphus jujuba*.

These forests are generally surrounded by numerous thickly-populated villages, and there is generally a heavy demand for firewood and grazing.

Inferior Type. This is confined chiefly to the northern portion of Chitaldroog and Tumkur Districts. It extends through Davangere, Jagalur, Molakalmuru, Challakere, Hiriyur, Sira, Pavagada and Maddagiri Taluks. It is a dry, arid forest tract, with very low rainfall, 15 to 20 inches. The growth is very poor. The characteristic tree growth is *Hardwickia binata*, with a little Cutch tree and other inferior and scanty growth.

The principal shrubs and useful bushes are : *Calotropis gigantea*, *Cassia auriculata*, *Cassia fistula*, and *Jatropha curcass*.

HORTICULTURE

The climate of Mysore is favourable to horticulture. With judicious treatment even plants of temperate climates may be grown at Bangalore successfully. Horticulture has made great progress, as may be judged from a visit to the Palace gardens in Mysore and Bangalore, maintained by His Highness the Maharaja, the public gardens maintained by the State at Mysore, Bangalore, Seringapatam and the Nandi Hills. Further evidence may be found in the horticultural activity displayed by the public, and in the successful establishment of nurseries by several local florists.

THE LAL-BAGH

The Lal-Bagh is the oldest and most important of the public gardens. It was started as an orchard during the time of Tipu Sultan, and is now being converted gradually into a botanical garden. It contains a fine collection of plants and trees rarely seen in India in such large specimens.

Fruit Trees. The Indian fruits and a large variety of fruits of temperate climate are grown in the vicinity of Bangalore, and the nurserymen do a considerable business in grafting the various kinds of mangoes and other fruit trees. The Washington Navel Orange was introduced some time back from Australia, but after a few years it does not seem to have taken kindly to this climate or soil. An experiment in bud-grafting has been made on the local hardy varieties, and so far it has proved successful. The Australian grapes were also introduced at the same time, and even they have suffered the same fate. Mangoes and plantains are grown in abundance, and some varieties of these are esteemed for their sweetness and flavour. Among the fruits grown the following are the most important:

Anacardium occidentale	..	Cashew-nut
Anona reticulata	..	Bullock's heart
Anona squamosa	..	Custard apple

Artocarpus integrifolia	..	Jack
Averrhoa carambola	..	Carambola
Carica papaya	..	Papay
Citrus aurantium	..	Orange
Citrus decumana	..	Pumelo
Citrus medica	..	Citron
Citrus medi a var. acida	..	Lime
Citrus medica var. limetta	..	Sweet lime
Citrus medica var. limonum	..	Lemon
Cocos nucifera	..	Cocoanut palm
Eribotrya japonica	..	Loquat
Eugenia jambos	..	Rose apple
Ficus carica	..	Fig
Mangifera indica	..	Mango
Musa sapientum	..	Plantain
Phyllanthus distichus	..	Star-gooseberry
Phyllanthus emblica	..	Emblic myrobalan
Psidium guyava	..	Guava
Punica granatum	..	Pomegranate
Pyrus malus	..	Apple
Vitis vinifera	..	Vine
Zizyphus jujuba	..	Bore
Eugenia malaccensis	..	Malay rose apple
Nephelium litchi	..	Litchi
Pyrus communis	..	Pear
Rubus lasicarpa	..	Raspberry
Achras sapota	..	Sapodilla
Anona muricata	..	Soursop
		Peaches

Vegetables. There are a large number of gardens in Bangalore and Mysore which supply the market with a rich assortment of both English and Indian vegetables. The chief among them are beans, soy-beans, tomatoes, cabbages, cauliflower, knolkhol, pumpkins, gourds, cow-gram, moringa fruit, brinjals, country greens, sweet potatoes, radish, and chow chow. The potato and the onion are grown on a large commercial scale. Leaves of vegetables and roots suitable for curries are also grown.

Agricultural Crops. The principal crops raised in the State may be classified briefly as follows:

(*a*) Wet, *i.e.* those that depend for their growth on irrigation in addition to timely rainfall, etc.:

Oryza sativa	..	Paddy
Saccharum officinarum	..	Sugarcane
Triticum sativum	..	Wheat

(*b*) Dry, which do not generally require irrigation, but are dependent entirely on seasonal showers of rain, *viz.*:

Eleusine corocana	..	Ragi
Sorghum vulgare	..	Great millet
Cajanus indicus	..	Pigeon pea
Cicer arietinum	..	Bengal gram chik pea
Dolichos biflorus	..	Horse gram
Dolichos lablab	..	Cow gram
Phaseolus mungo	..	Green gram
Phaseolus mungo var. / *Phaseolus radiatus*	..	Black gram
Sesamum indicum	..	Sesame, gingelly
Ricinus communis	..	Castor
Gossypium herbaceum	..	Cotton
Nicotiana tabacum	..	Tobacco

(*c*) *Garden Crops*, which require a moist situation and an adequate supply of water:

Areca catechu	..	Areca nut
Musa sapientum	..	Plantain
Cocos nucifera	..	Cocoanut
Elettaria cardamomum	..	Cardamom
Arachis hypogæa	..	Ground nut
Capsicum annuum	..	Chilly
Allium cepa	..	Onion
Allium sativum	..	Garlic
Carum copticum	..	Bishop's weed
Carthamus tinctorius	..	Safflower
Coriandrum sativum	..	Coriander
Curcuma longa	..	Turmeric

Trigonella foenum græcum	..	Fenugreek
Zingiber officinale	..	Ginger
Cuminum cyminum	..	Cummin seed
Piper betel	..	Betel vine

Mulberry is cultivated both in gardens and dry lands. Coffee is a miscellaneous crop grown in the Malnad regions of the Kadur and Hassan Districts.

The Department of Agriculture has succeeded in combating the diseases on three important crops, *viz.* Areca nut, Potato, and Coffee.

M. A. SAMPATHKUMARAN.

A BRIEF NOTE ON THE PROGRESS OF EDUCATION IN THE MYSORE STATE

In earlier times Oriental learning on traditional lines flourished at various centres in the State, and learned pandits gathered round them small groups of students, to whom they imparted their wisdom. Secular education of an elementary character was imparted in private schools. His Highness the Maharaja Krishnaraja Wadiyar III established a free school at Mysore in 1833 at his own cost, and certain missionary bodies had opened schools in a few centres, receiving aid from Government. But education, organized on modern lines, began in Mysore, as elsewhere in India, only after the famous Halifax Despatch of 1854, which defined the groundwork on which the present system of Indian education was built up. In accordance with the provisions of this Despatch, a scheme of education for the State was drawn up, which provided, under direction, for a Director of Public Instruction, two inspectors, four deputy inspectors, and 20 sub-deputy inspectors; and under schools, for a central college, four A.-V. schools of a superior class, one for each division, 80 vernacular schools, one for each taluq, and two normal schools, one for the Maidan and the other for the Malnad parts. The whole scheme was estimated to cost about Rs. 1,13,000. The institutions that had already been started at Tumkur, Shimoga, and Hassan, by missionary bodies, were taken over by Government, as also the Maharaja's English School at Mysore, to serve as divisional high schools. A Government High School was established in Bangalore in 1858, and was affiliated to the Madras University. In 1861 a Normal School for the training of teachers for taluk schools

was opened in Bangalore, and the following year an Engineering School was started.

The progress of the taluk schools was slow, and in 1865 there were only 18 Government schools in taluk stations, with 30 schools which received grant-in-aid.

In 1868 a large scheme for expansion was formulated by Mr. Rice. It was a scheme to establish a school for each of the 645 hoblies, in order to bring education within the reach of the mass of people. The policy was to give a school where the people wanted one and on condition of their giving a school house. The teachers were to get Rs. 7 a month, and the cost of the schools was to be met from a cess to be levied on land revenue. The schools were to be supervised by local committees, appointed on the recommendation of the revenue authorities. In spite of the difficulty of securing competent teachers for these schools, their number rose slowly and steadily, and in 1868 normal schools had to be started in all District headquarters to train teachers for them. By the year 1872, almost all the hoblis had schools and all taluks had their higher vernacular schools, and there were 11 district schools teaching up to the Matriculation standard, and five high schools teaching up to the B.A. standard. Of these, one high school and two district schools were in the C. and M. Station There was also a steady rise in the number of grant-in-aid schools. At the close of 1871-72 there were 693 institutions with 24,201 scholars, the expenditure on education being Rs. 3,27,621. In 1875 the Bangalore High School was given the name "Central College," and affiliated to the Madras University as a First Grade College; and the Maharaja's School, Mysore, and the District School, Shimoga, were made high schools teaching up to the F.A. A School of Engineering and Natural Science was also started and affiliated to the Madras University, but it was reduced a few years later to a lower grade, as the needs of Government did not require a college of this kind.

The growth of education was a little retarded during and immediately after the famine of 1877, most of the aided schools having disappeared, and Government, in its policy of retrenchment after the famine, having had to abolish the Normal Schools. But before 1881, the year of the Rendition of the State to the Maharaja, the number of schools and scholars had regained their strength, the total number of institutions at this time being 2,087 (of which 899 were Government), the number of scholars 57,657, and the total expenditure on education Rs. 3,91,028.

Progress after the Rendition was rapid. The encouragement and promotion of a scholarly study of the local vernacular and of Sanskrit was included in the educational policy. A local examination in Kannada was instituted in 1887. The Karnataka Bhashojjivini Sabha was established in 1886, with a Kannada College attached to it. The Sanskrit School, at Bangalore, was raised to the status of a College and the Maharaja's Sanskrit College at Mysore, was improved and developed. Women's education received great impetus by the starting of the Maharani's Girls' School at Mysore. Technical education was encouraged by the institution of scholarships for the study of technical subjects outside the State. The progress achieved up to 1886 in education generally, and in women's education particularly, was greatly appreciated in a public speech by Lord Dufferin, Viceroy of India, during His Excellency's visit to the Mysore State in that year.

The next 10 or 12 years saw further development, when progress was temporarily arrested by plague in 1898. The Maharaja's College was raised to a First Grade College and the college staff strengthened and the higher services were graded. As for secondary education, the cost of taluk English schools (A.-V. schools) was transferred to State funds. Students' homes were established at Mysore, Chitaldrug and Kolar, and Normal Schools were re-started in Mysore, Shimoga and Kolar. The Maharani's High School, which was in receipt of a grant, was taken under Government

management and placed under the supervision of a committee. Committees were appointed for all Government girls' schools. Scholarships were instituted for widows whose caste system did not allow of remarriage. The Oriental Library was established in Mysore, for the collection of rare and important works and manuscripts in Kannada and Sanskrit. Industrial schools were opened in Hassan and Mysore. Scholarships were instituted with a view to encourage education among Muhammadans and Pollegar families, and schools were opened for the Depressed Classes.

Various changes in the administrative organisation were also made, and the designation of the head of the Department changed from Director of Public Instruction to Inspector-General of Education. The grades and pay of the tutorial service of the Department were improved, and a new gradation of the officers made. The inspectorate was strengthened. In the field of technical education, provision was made in the Industrial School, Mysore, and other technical institutions in the State, for teaching such useful subjects as modelling, carpentry, weaving, wood-carving, masonry, rattan-work, blacksmith's work, book-binding, tile-making, aluminium ware, etc. After a temporary check due to the havoc worked by plague in 1898, education made rapid progress again, so that by 1900-01 the expenditure had risen to nearly 11 lakhs.

1901-1911. The next 10 years, up to 1911, saw a general development of education, in which technical education had a good share. An Engineering School was opened in Mysore, and the Government Industrial School, Mysore, was re-organized, and more industrial schools opened at various centres, and liberal provision was made for scholarships for the study of technical subjects. The Tata Silk-Farm, at Bangalore, which received a grant-in-aid, was made use of for training village school masters in sericulture, with a view to employing them to instruct villagers in the methods of sericulture, and in 1907 manual training (Sloyd) was introduced into the curriculum of secondary schools in

order to correct the too "literary" tendency of the course, and an expert obtained from America to train teachers in Sloyd, and a lady expert from England to train teachers in Kindergarten. It was also during this period (1909) that a scheme of religious and moral instruction was introduced into the schools of the State.

In 1902-03 the Maharani's Girls' School was raised to a Second Grade College. Education in village schools was free till 1904, when fees were first introduced; but in 1908 fees in such schools were removed. The pay of village school masters was raised to a minimum of Rs. 10 per mensem in 1908, and to Rs. 15 in 1921.

One very important feature of the period was the final decision to locate the Indian Institute of Science in Bangalore. The Madras University having introduced new regulations in 1907, the high schools and colleges were re-organized so as to suit the new requirements. The progress of education up to 1910-11 is indicated by the rise in the number of institutions to 4,267 (public and private), and of pupils to 1,38,153, and of the total expenditure on education to nearly 19 lakhs.

The quinquennium (1911-16) that followed was an era of great activity. This was due largely to the efforts of the Mysore Economic Conference, which was formed in June, 1911, and which had education as one of its chief sections of work. One of the most important schemes sanctioned by Government was the introduction of Compulsory Education. The Elementary Education Regulation was passed in 1913, and the University Regulation later on, in July, 1916. With a view to expand primary education 1,100 schools were opened in villages in 1914-15 on the monthly salary grant system, and an additional 1,000 such schools in the following year; while separate schools were started from 1914, for the education of adult labourers and artisans, which by 1916 had risen to 536 in number, with a strength of 11,135 adult pupils. The courses of study in elementary schools were modified by the introduction of elementary instruction in industrial subjects, such as carpentry,

sericulture, agriculture, shoemaking, etc., the scheme having been introduced into 91 centres up to 1916. A mechanical engineering school was started in Bangalore and two commercial schools, one in Bangalore and one in Mysore. The Chamarajendra Technical Institute was developed, with an engineering, an industrial and a commercial section. The foreign scholarship rules were revised, and foreign scholarships from the State funds were instituted in addition to Damodar Das Scholarships. One of the important results of the activities of the Mysore Economic Conference was the Kannada Academy, which was started in 1913, its object being the development of the Kannada language and literature.

In the field of secondary education, the most noticeable features were the introduction of the S.S.L.C. scheme in 1913, and the expansion of vernacular secondary education by the opening of additional upper secondary schools in five centres for boys and two centres for girls. The Normal School at Mysore was raised to the status of a College, with new sections for training in English, and a Normal School opened in Tumkur.

The progress of women's education up to 1914 was slow though it was steady, as the number of girls under instruction in that year was only 27,500, out of a total school-going population of 4¼ lakhs of girls. As an inducement to girls to join schools and continue therein, 700 scholarships, of value varying from half rupee to Rs. 2, according to the classes in which they studied, were instituted, and additional scholarships of higher value were sanctioned for girls in the lower secondary and higher classes. Upper secondary classes were opened in Tumkur and Bangalore and lower secondary classes in Bangalore and Kolar—all for girls. The primary classes were separated from the Maharani's College, and separate primary schools opened for them in Mysore. A Government hostel was established in connection with the Maharani's College, the "Widow's Home" in Mysore being taken over by Government for

the purpose, and the poorer boarders were fed free of charge.

The education of the Depressed Classes also made good progress, the number of institutions for them having risen from 106 in 1911 to 289 in 1916, and the number of scholars from 2,838 to 7,115. The establishment of the Central Panchama Institute, in Mysore, with provision for both general and industrial education, marked an important step in the education of these classes.

In 1901 an aided institution was started in Mysore for the education of the deaf mutes and the blind. It has been very popular and has steadily progressed. During the quinquennium, the school trained 81 deaf-mutes both in elementary reading and writing, and in such useful industries as carpentry, rattan-work, weaving and tailoring, and 127 blind pupils in the three R's by the Braille System and in useful industries. The blind are also taught music, for which they are said to show great aptitude, and one of the blind pupils of the Mysore school distinguished himself in the All-India Music Conference, held at Baroda in 1915-16.

At the close of 1915-16, the total number of institutions stood at 7,258, with 2,39,112 scholars (of whom nearly 40,000 were girls), the total expenditure on education being nearly 28 lakhs.

During the succeeding years (1916-23) the policy of expansion has been continued, with increased facilities for the education of special communities, the largest figures in the number of institutions, 11,487 (including 2,671 adult schools), having been reached in 1918-19, and the total number of scholars having stood at its highest, 3,39,969, in 1919-20; though the corresponding figures stood at 8,792 and 2,87,794 at the close of 1922-23, the decrease being due to several causes, one of which was the disappearance of a number of salary grant schools and adult schools, which were found to be working unsatisfactorily and had ceased to receive local financial support to supplement the Government grant. One of the most important features of the period was the

starting of the Mysore University, in July, 1916. Another was the issue of orders by Government, in May, 1921, on the Educational Memorandum, in which the policy of the Government in regard to education in all its branches was reviewed and the lines of future activity definitely laid down. The reforms dealt with, when given full effect to, will involve a total expenditure of nearly 60 lakhs, exclusive of the cost of University education.

The policy in regard to primary education is one of expansion so as to reach a maximum of 10,000 primary schools in six years, to convert aided schools to Government institutions according to certain conditions and a definite programme, and eventually to hand over primary education to Local Bodies, and to require Municipalities to pay a portion of the cost of compulsory education in cities and towns. Some of the districts have already levied a cess to meet the cost of primary education in their jurisdiction. The primary department has been completely separated from the secondary department of all schools, the former being started as separate primary schools, and the curricula for both the departments have been revised. The course between the infant standard and the lower secondary standard has been increased from 7 to 8 years, divided into a primary and a middle course of 4 years each. The primary course will be one entirely in the vernacular (Kannada or Urdu); and the middle course will be of the bilingual type (English and a vernacular) and given in the middle school (4 years' course) preparing candidates for a public examination (English Lower Secondary Examination), success at which qualifies boys for admission to the IV Form.

In 1919-20 fees were abolished in all lower secondary classes, and this concession has evidently been taken advantage of by many, as indicated by the increasing number of pupils for the lower secondary examination (over 9,000 for 1923). Government have also provided for the conversion of incomplete middle schools to middle schools at the rate of 50 a year.

The number of high schools rose from 16 in 1916 with 5,414 pupils, to 21 in 1923 with a strength of 5,879. The corresponding increase in the number of candidates for the S.S.L.C. is from 801 to 1,901. The experience of the past ten years in the working of the S.S.L.C. scheme having revealed many defects in it, proposals for the revision of the scheme are under consideration. So far as the medium of instruction is concerned, Government has laid down that while vernacular shall be the medium in middle schools, it is desirable for several reasons that English should continue to be the medium in high schools. Due provision has also been made in the orders of Government for the efficient staffing of schools, and for adequate supervising agency, consistent with the expansion contemplated, as arrangements are to be made for an annual output of 500 trained teachers, and the inspecting staff is to be strengthened and improved. An entire revision of the grades and pay of all classes of educational officers is also provided for.

Sanskrit education was placed on a better footing by the revision of its courses and curricula and the combination of English with Sanskrit, so as to create opportunities for the cultivation of ancient and modern knowledge side by side.

Women's education made very rapid strides during the quinquennium, the number of schools in 1916 having been 525 with 41,035 girls under instruction, the corresponding figures for 1922-23 being 777 schools and 63,571 pupils. The courses and curricula in primary and secondary schools for girls were revised so as to suit their requirements. Special grades, with liberal scales of pay, have been provided for lady graduates, and more mistresses and inspectresses have been employed. A U.E. class was opened in the Vani Vilas Institute, Bangalore. The total expenditure on women's education rose from 3 lakhs in 1916 to 5½ lakhs in 1922-23.

In its early stages, the progress of Muhammadan education was slow, for in 1871-72 there were only 27

schools for Muhammadans, of which only 5 were Government schools. Only one in every 84 was literate. During the next 20 years the progress was still slow, the number of Muhammadan schools in 1891 having been 127 with 5,359 pupils. A more rapid progress marked the next 25 years, at the end of which, in 1916, there were 530 institutions (344 Government) with 21,851 pupils. In 1922-23 there were 950 schools, and 38,845 pupils under instruction, of whom 10,197 were girls.

The early history of Depressed Classes education is one of very slow progress. The earliest attempts for their education were due to missionary enterprise, and it was in 1890 that Government schools were first opened for them. By 1901 the progress made was represented by an increase in the number of schools to 65, and of scholars to 2,523. The quinquennium ending 1915-16 saw a very rapid spread of education among the community, the number of schools and scholars on 30th June, 1916, being 287 (171 Government) and 7,115. During the next few years the progress made far exceeded that attained during the preceding period of six decades. This was due largely to the solicitude with which Government took up the cause of Depressed Classes education, by such steps as the opening of Panchama boarding schools in Mysore, Tumkur, Chickmagalur, and recently, in Bangalore, provision for industrial education side by side with general education, starting more primary schools, liberal provision for scholarships and clothing, free supply of books and slates, exemption from school and examination fees, and admission to general schools in all localities. The result of this liberal policy is reflected in the rise of the number of Panchama schools from 287 in 1916 to 739 in 1921, and of Panchama pupils from 7,115 to 15,390.

The State has a very liberal system of scholarships for studies outside the State in Indian and foreign institutions, for technical and professional studies, inside and outside the State and for the encouragement of special classes and backward and depressed communities, and for girls. A large number of young men have been

trained in Europe and America, and suitably employed in the various Departments of Government. The Scheme of Backward and Depressed Class Scholarships, amounting to one lakh a year, was sanctioned in 1917, for giving a special stimulus to education among the masses of the people, who were not freely resorting to education. The total amount of expenditure on account of scholarships, which was only Rs. 21,000 in 1891, rose to Rs. 3,65,000 in 1922.

The statistics relating to the progress of education at the beginning of each decade from 1880, are given below under the heads: Year, No. of institutions, No. of scholars, percentage of scholars to school-going population, and expenditure on education.

Year.	Total No. of Institutions	No. of Scholars	P.C. of Male Scholars to Male Popn. of School Age	P.C. of Female Scholars to Female Popn. of School Age	Total Expenditure
1880	892	36,723	..	..	3,92,264
1890-91	3,410	96,427	23·67	2·78	6,39,737
1900-01	4,009	1,16,468	24·09	4·22	10,98,170
1910-11	4,267	1,38,158	27·9	5·7	18,79,133
1920-21	10,480	3,24,555	62·12	13·2	48,09,885
1922-23	8,792	2,87,794*	52·3	12·42	43,64,293

* The total strength of 2,87,794 for 1922-23 is made up as follows:

Primary Stage	Boys	1,94,896
	Girls	49,161
Middle Stage	Boys	28,036
	Girls	3,926
High School Stage including U.E.	Boys	6,881
	Girls	183
Oriental College and Special Institutions	.. ..	4,711
	Total	2,87,794

C. S. BALASUNDARAM IYER.

A REVIEW OF WOMEN'S EDUCATION IN MYSORE

THE beginnings of girls' education in the State go back to the early eighties of the last century, when the Maharani's School, bearing the illustrious name of Her Highness the Maharani, C.I., Vanivilas Sannidhan, was founded by the late Rai Bahadur A. Narasimha Iyengar, the pioneer educationist in Mysore. Considering the formidable nature of the obstacles overcome, the success achieved in the long period of over forty years is something to be really proud of. The popular prejudices against girls' education have worn off; schools have multiplied, testifying to the rapid spread of literacy among the rising generation; primary education has been made compulsory in the urban areas; after centuries of repression women are coming out demanding their legitimate place in society, and evincing interest in politics too; the spread of knowledge and enlightenment has rendered possible more than one victory in the field of social reform, as, for instance, the raising of the marriageable age of girls and the visible improvement in the lot of the unfortunate girl-widows; our women, placed as they are in domestic and social environments not altogether conducive to the pursuit of higher studies, have vindicated their marvellous capacity for the highest academical knowledge and culture, and have earned distinction in the public service as professors and teachers, doctors and nurses; and, lastly, as a fitting climax to the expansion of girls' education, the Maharani's School has blossomed forth into a constituent part of the Mysore University, under the liberal encouragement of the Government. All these indicate no small measure of success; and yet it cannot be said that

higher education in the State has advanced very far from the experimental stage. In spite of education being free in all grades and the inducement offered by handsome scholarships, the question of the higher education of women still remains a problem patiently awaiting a happy solution.

It is admitted everywhere that the canker of early marriages and motherhood is at the bottom of all our social ills, sapping the very vitality of the nation. But apart from this curse, which is common to the whole of India, there are certain things relating to the local conditions which account for the slow progress of higher education in the State. In the first place, Mysore is a small area in comparison, for instance, with the neighbouring Presidency of Madras, which has a wider field to attract students, especially from communities like the Christian, Nair and Konkini, which are free from or have thrown off the incubus of early mariage. Secondly, for the *two* girls' high schools maintained by the State which supply students to the single college here, Madras has *two hundred* strong feeders to its two colleges. Thirdly, no facilities exist in Mysore for the study of science subjects in the academic course, even though the demand for it has been increasing from year to year. Fourthly, the want of a good hostel and the lack of provision for the teaching of vernaculars, such as Tamil, Telugu, and Marathi, which prevail in the adjoining provinces, effectively hinder students from outside venturing forth to obtain the benefits of college education in Mysore ; and lastly, and by no means the least important of all, the fact that Bangalore, being the headquarters of the Government, with its excellent climate and large population, would have served as a better educational centre for women, as it is for men. Remodelling the higher courses of study so as to suit the needs and requirements of women at home and in society, and making the vernacular the medium of instruction, seem desirable to popularise women's education ; but it must be admitted that such alterations in the present system would be far from beneficial to those who intend follow-

ing the learned professions. There is no gainsaying the fact that at present the benefits of higher education, as imparted in our colleges, are sought chiefly as a means to economic independence, and the economic value of education will certainly be lowered if a high standard of efficiency be not maintained. It is a matter purely of finance to give women the option of two alternative courses of study, a higher one for those who are able to enter the University portals and a lower one to the rest of the women-folk. Fuller and greater facilities for the pursuit of either course, in accordance with individual aptitudes and needs, are the things that are required to promote the cause of women's education in Mysore.

K. D. RUKMINIAMMA.

EDUCATION IN THE CIVIL AND MILITARY STATION OF BANGALORE

THE Civil and Military Station of Bangalore is a considerable educational centre. Partly owing to its climatic advantages, partly because of its long history as a station for troops, it is one of the largest settlements of Europeans and Anglo-Indians in the South of India. Also owing to the fact of its being a station for Indian troops, who are drawn largely from the Tamil depressed classes and Muhammadans, the majority of the pupils in the schools speak Tamil and Hindustani. There are, besides, many Telugus, Kanarese and some Mahrattas, as well as a sprinkling of other peoples. It is a polyglot city and the schools reflect this characteristic, and special difficulties in staffing and the organisation of classes occur.

Administration. Until March 31st, 1923, the schools were under the supervision of the Director of Public Instruction, Madras. The local officer was the Inspector of Schools of South Kanara (Madras Presidency), Coorg and Bangalore. With a change in the organisation of the inspecting agency in Madras, he ceased to have a district of Madras under his control, and became Inspector of Schools, Bangalore and Coorg. The supervision of the Director of Public Instruction, Madras, ceased at the same time, and the control and supervision of all schools in Bangalore passed to the Inspector of Schools under the authority of the Resident in Mysore. He is assisted locally by a sub-assistant inspector of schools for the C. and M. Station in the administration and inspection of all elementary schools; Muhammadan schools, however, are inspected by officers

deputed by the Government of Madras. Until March 31st, Bangalore was the headquarters of a Muhammadan sub-assistant inspector, whose work lay largely in South Kanara.

Colleges. There are two second grade colleges affiliated to the University of Madras, *viz.* the Sacred Heart College for girls and St. Joseph's College for boys. Both work up to the Intermediate examination and are affiliated in Group III (History, Logic and Languages). St. Joseph's College, however, is in process of development; a Science Branch (Group I, Mathematics and Science) is being added, the capital cost of which, both building and equipment, is being borne by Government. A Government grant of Rs. 10,000 annually is paid towards the recurring cost. The French Foreign Mission, under the Bishop of Mysore, has undertaken this development. Formerly situated in St. Joseph's (European) College premises, the enlarged college will be open to all classes and races.

Schools: European. There are seven European high schools: three for boys and four for girls. They are run by various religious agencies: Roman Catholic, Church of England and American Evangelical Lutheran. They are:

Boys. St. Joseph's College.
Bishop Cotton Boys' School.
Baldwin Boys' High School.

Girls. Sacred Heart College.
Bishop Cotton Girls' School.
Baldwin Girls' School.
St. Francis Xavier's Girls' High School.

There are besides three middle schools (teaching up to standard VII under the European Code), and nine primary schools. Of these, three are orphanages and two are poor day schools. Boarding grants are paid to the orphanages in addition to the ordinary teaching grants. There being no publicly-owned schools for

European and Anglo-Indian children, aided schools under the European Code provide both elementary and secondary education for them.

Examinations. The European schools work under a Code which is identical with that in vogue in Madras, and the high schools have hitherto sent up pupils for the European High and Middle School examinations conducted by a Board in Madras. In future, from 1924 onwards, a separate Examination Board will be established for Bangalore.

Pupils are also sent up for the Cambridge Local examinations, of which the Inspector of Schools is officially recognised as Local Secretary. The European Schools Examination Syllabus has been revised to a higher standard, especial attention being paid to Mathematics and Science.

From the middle and primary schools pupils leave without passing an examination; efforts are being made to give them a practical training, and in three schools carpentry has been introduced; in three typewriting is taught; the girls are taught also needlework and given domestic training.

Training. There is one aided training school for girls (the Sacred Heart Training School) under the European Code. Some girls are trained also under the Madras Educational Department's Training Scheme, with English as their language, in St. Euphrasia's Training School.

Numbers. The number of European and Anglo-Indian pupils in the colleges and schools was, in 1922-23, 1,098 boys and 1,351 girls; there were also in these institutions 232 non-Europeans.

Expenditure. The total expenditure (direct and indirect) on European education was in the last official year Rs. 4,94,600, towards which the Government contribution was Rs. 1,67,700 in round figures.

Schools: Indian. Indian schools are classified into secondary and elementary, according to the Madras Educational Rules, which are in force in the Station.

Secondary. There are two high schools for boys and one for girls. They are :

St. Joseph's College (Indian Section).
The R.B.A.N.M.'s High School (managed by an Indian Committee).
The Wesleyan Mission Tamil Girls' High School.

All three are complete secondary schools, from the lowest to the highest grade of school instruction (Form VI). The number of boys in the two boys' high schools was last 1,086, and in the girls' high school there were 273 pupils, including 26 little boys. The largest of these institutions is St. Joseph's College. Attached to the Tamil Girls' High School is a boarding house, intended for Christian girls ; school and boarding house are under two English ladies.

There are besides three incomplete secondary boys' schools, in which 749 pupils were reading last year. These end with Form III : but up to that stage work to the same standard as the high schools, to which they send on pupils.

Examinations. The ultimate goal is the Madras S.S.L.C. examination, on marks obtained in which the Madras University issues a list of eligibles for admission to its affiliated colleges (Intermediate classes).

Elementary Boys'. There are 45 recognised elementary boys' schools in the Station, of which 12 are Municipal schools, and 2 are Government, 31 schools receive aid from Government. In all these schools the total number of boys is 3,648 ; to which must be added 453 girls. There are 17 unaided and unrecognised schools with 760 boys in them.

All but one of the Municipal schools are well-housed, many of them have good compounds, the walling in of which is now in course of completion. Besides the three Rs, some English, and geography, history, etc., a special feature of the work in many schools is gardening, towards which the Municipal Commission contribute Rs. 600 a year. Wood work is taught in three schools, and will be started in a fourth. Five of these schools

are for Muhammadans, and two for depressed classes; the latter, however, are not excluded from any Municipal school. There were 1,258 boys and 109 girls in these schools in 1922-23.

Many of the aided schools also are well-housed, but usually the space about them is less than in the Municipal schools. Many of the schools are run by Mission bodies or other agencies specially for the depressed classes. There were 2,345 boys and 328 girls in these schools in 1922-23.

Girls. There are three higher elementary girls' schools (*i.e.* reading up to standard VIII of the Madras Code), and 17 lower elementary (up to standard V); of the latter four are Municipal and 13 aided. In all these schools were 2,580 girls and 101 boys. In six unaided schools there were 126 girls and five boys in 1922-23.

The four Municipal girls' schools are well-housed; as also several of the aided schools, which were built wholly or partially out of Government grant.

Instruction in general follows the lines of teaching in boys' schools, but singing and needlework are added.

Training Schools. There are two training schools for Indian teachers, both started within recent years. The effect of them is seen in the much-improved quality of the staffs of both boys' and girls' schools.

(1) The Government Training School, which is now amalgamated with the Coorg Training School, to which has been added a secondary section from June, 1923, gives training in English, Tamil, Telugu and Kanarese. Muhammadans are sent usually to Madras.

(2) St. Euphrasia's Training School (in the Good Shepherd Convent) trains also for the secondary and elementary grades in the languages mentioned above. It receives aid from Government.

Government stipends are paid to students under training in both these institutions.

Special Schools. (1) In the R.B.A.N.M's. High School there was formerly a technical school, which trained

for the subordinate branch of the P.W.D. This has now been closed, and the buildings are rented for the Government Training School and for an Industrial School. The latter, opened a year ago, gives at present only training in carpentry; it will be developed both in staff and equipment. The cost of this is borne by Government; stipends (Rs. 5 per month) also are paid by the Muncipal Commission for boys from Municipal schools. Anglo-Indians, Muhammadans, Hindus, Christians and Panchamas are on the rolls.

(2) This year a small continuation school of gardening has been opened, in a neighbourhood of professional gardeners. The experiment promises to be a success. This school is managed by the Municipal Commission, but financed by Government.

(3) The Y.W.C.A. have a typewriting school, which is aided by Government. It is held in the Y.W.C.A. premises, Residency Road.

General—Indian Schools. During the official year 1922-23, there were 99 Indian schools, comprising 76 recognised high, middle, primary, training and technical schools, and 23 unrecognised schools. The total number of pupils attending these was 9,583. The total direct expenditure on all these schools amounted to Rs. 2,02,571, towards which Government contributed Rs. 86,373.

J. A. YATES.

UNIVERSITY OF MYSORE

THE University of Mysore was the first university to be founded in the Native States of India. For over twenty-five years the two State colleges were affiliated to the Madras University, and it was felt that the time had come to effect certain changes with a view to adapt the educational system of the State to the actual needs of its people, who number about six millions, the State having an area of about 30,000 square miles. A scheme for a University was accordingly prepared in consultation with the educational experts of the Government of India and the officials of the State. A Bill to establish and incorporate a University was introduced into the Mysore Legislative Council in June, 1916, which was unanimously passed on July 17th. It received the sanction of His Highness the Maharaja on the 22nd July; and on the 25th a *Mysore Gazette Extraordinary* published the Regulation establishing the University. The first meeting of the Council was held on the 12th August, 1916, and the first Senate Meeting on the 12th October following.

This University has some features which distinguish it from the older Indian Universities. The Vice-Chancellor is a full-time officer and has control of the executive. The colleges are adequately represented both in the Council and in the Senate, of which latter every professor designated as University Professor is a member. The school course leading to the University has been extended by one year, during which special preparation for the University is made in certain recognised schools, known as collegiate high schools. The University course is reduced from four to three years, and there is no intermediate public examination to break the continuity of the B.A. course. Other features are

the reduction of the amount of English taught and its practical character, the increased emphasis laid on the vernaculars and the special attention paid to the optional languages of Sanskrit and Persian. For those who wish to specialise in science, there is a B.Sc. course in addition to the B.A. Science course.

The University Unions at Bangalore and Mysore afford opportunity to the students, members of the college staffs, the fellows of the University, and the registered graduates, to enjoy the best club life, and to come into intimate social relations with each other.

The institution of the system of University Extension Lectures and of a Publication Bureau is evidence that the University is conscious that its activities should not be confined to the four walls of its colleges, but should extend its benefits to those who are not members of the University.

The University is State-supported, except for the income derived from fees and from the endowments for the award of some of the prizes and scholarships.

There are at present four constituent colleges, the Maharaja's and Maharani's Colleges at Mysore, and the Central College and College of Engineering at Bangalore.

THE MAHARAJA'S COLLEGE, MYSORE

The institution was established in 1833 by the late Maharaja as a free English school, according to the inscription still existing over the principal gateway. On the demise of His Highness, in 1868, the school was taken over by Government, and called the Raja's School. The school had for several years sent up candidates for the University examinations, when in 1875 it was formed into a high school. All classes below the upper fourth were abolished in July, 1884. It was affiliated as a second grade college in 1879, and as a first grade college in 1894. In 1916 the Government of His Highness the Maharaja of Mysore incorporated it into the new University of Mysore, founded in that year, in consequence of which

the Junior Intermediate in Arts and Junior B.A. classes were discontinued. The Honours, Senior B.A. and Senior Intermediate in Arts classes, organised on the plan of the Madras University, were in due course closed.

There is a students' hostel connected with the college.

The optional subjects taught in the college are History, Mental and Moral Philosophy, Economics, Political Science, Sanskrit and Persian. There is also a Commerce course leading to the B.Com. degree, and there are courses also for the M.A. degree in English, History, Economics, Political Science, Philosophy and Sanskrit.

THE MAHARANI'S COLLEGE, MYSORE

The institution formerly known as the Maharani's College, which was opened in 1881, consisted until the year 1920 of a college department, high school department, middle school department, primary department, training department and Oriental classes. The college department until 1916 was affiliated to the Madras University as a second grade or Intermediate Arts College in group III, that is, with Ancient and Modern History and Logic.

After passing the Intermediate Arts examination, special provision had to be made for girls proceeding to the B.A. degree. Such provision was first made in 1900, and this special B.A. class continued up to the end of 1908, when it was abolished owing to lack of students. From 1911 to 1916 arrangements were made to continue the study of successful Intermediate students at the Maharaja's College. In 1916, when the Mysore University was founded, the Entrance Class at the Maharani's College was started, and in the following year the first year B.A. class was formed in the college. In the year 1919, there were first year, second year and third year classes, all engaged on the Mysore University courses. A further step was taken this year. The college was

constituted into a separate department by itself, apart from the school, and placed directly under the control of the University. The three College classes and the Entrance class are under the University.

The optional subjects taught in the college are History, Economics, and Political Science.

CENTRAL COLLEGE, BANGALORE

The Central College, Bangalore, is the science school of the University of Mysore. The college teaches the three years of the University courses for the degrees of B.A. and B.Sc. in the following sciences : Physics, Chemistry, Mathematics, Zoology, Botany and Geology.

In addition to combinations of these subjects, English and a second language form part of the curriculum for all students. The strength of the college is about 450 students and 33 staff.

The laboratories and lecture rooms are housed in four large blocks of buildings. The Physics block contains two lecture theatres, a large elementary laboratory, and special rooms for electrical and optical work. It is provided with a well-fitted workshop, an electric storage battery, and a plant for manufacturing liquid air and electric current, both alternating and direct, for power and lighting ; gas, water and compressed air are laid on.

The Chemistry block also contains two lecture theatres and spacious and conveniently-fitted laboratories for both elementary and advanced work. Electric current, etc., are laid on, as in the Physics block. The Chemistry department is well equipped for work of the most advanced character.

The department of Mathematics is a particularly popular one. It has done excellent work both in teaching and in original research during the past decade.

The Natural Science departments (Botany, Geology and Zoology) are smaller than those just mentioned ; they are, however, excellently equipped and staffed, and

turn out work of high quality. Each of these departments maintains a museum or collection of specimens, all of which have become valuable assets of the college.

Each of the Science sections possesses an up-to-date reference library of books bearing on its own particular subjects.

The department of English is the strongest in the college, since each student of the college studies English during the whole of his course. The department is under the close supervision and control of two European Professors.

The General Library contains 6,500 volumes, chiefly works of general reference, copies of English classics, etc.

A comfortable hostel, accommodating nearly 100 students, is attached to the college, and a Union building is on the point of completion.

College sports receive due attention, and cricket, tennis, football, and hockey are popular games. A University Training Corps is under contemplation.

THE COLLEGE OF ENGINEERING, BANGALORE

The College of Engineering, Bangalore, was started in the year 1917, under the auspices of the Mysore University, to impart advanced instruction in Applied Science in the three branches of Engineering, viz. :

1. Civil Engineering.
2. Mechanical Engineering.
3. Electrical Engineering.

The course is laid out on somewhat different lines from that pursued in the other Indian Universities, but is moulded on the lines of some of the well-known American and English Universities.

The work of the student while at college is confined to those phases which can be handled best in the class room, leaving training in technique, as far as possible, to the shop and the field, the aim being not to burden the student with too much detail, but to enable him to learn

where to get detailed information on any question that may arise in practice. While giving a thorough grounding in the fundamentals, the training throughout the course is largely practical and experimental.

The college instruction is followed up by adequate shop training and practical experience, not merely in the college workshop but in commercial concerns which have to compete with each other and where efficiency and time are inseparably present, and where therefore the student can learn the essentials from a business point of view.

The fundamentals underlying the study of the three branches of Engineering, *i.e.* Civil, Mechanical and Electrical, are the same, and include :

1. Physics.
2. Chemistry.
3. Geology.
4. Mathematics.
5. Mechanics.
6. Strength of Materials.
7. Power Generation and Mechanism.
8. Electricity.
9. Drawing.
10. Surveying, Levelling and Mapping.

It is essential that every engineer should be grounded in the fundamentals in the above subjects ; while all refinements and advanced studies may be left for specialisation. The first two years are devoted to this general course. This includes an elementary workshop course, including machine shop. At the end of this course comes the Intermediate Examination in Engineering.

The successful students pass on to the degree course, which is an advanced course in engineering. Here specialisation begins, and the students have to select one of the three branches for advanced study for a further period of two years. During this course the students attend lectures in separate sections in the advanced portions of the respective branches. General studies

and those dealing with management are common courses for all sections.

After passing out, the students have to undergo one year's apprenticeship in an approved institution, firm, factory or works, to entitle them to the degree. During this period the students are granted stipends, and a watch is kept on their progress by the college.

During the degree course practical work plays a prominent part. The students are put through advanced machine shop work and work in the various laboratories.

Survey camps for outdoor surveying, levelling and mapping, and visits to important engineering works in India, are also provided for.

The workshops and laboratories are fully-equipped for instruction and practice in Smithy, Carpentry, Fitting, Foundry, and Machine Shop. The testing laboratory affords facilities for testing strength of materials in tension, compression, shear, torsion and combined stresses ; power plant testing for various types of prime movers, steam, electric, internal combustion, Diesel, etc. There are also hydraulic and fuel and oil testing laboratories.

The main features of the whole scheme are :

1. Two years' course in fundamentals.
2. Two years' course special studies.
3. One year's course apprenticeship.

It is under contemplation to open a research section for training a few students in research work.

The electrical branch is not yet opened as a separate course for the B.E. degree.

INDIAN INSTITUTE OF SCIENCE, BANGALORE, 1911-1923

THE Indian Institute of Science owes its origin to the genius and munificence of the late Mr. Jamsetjee Nusserwanjee Tata, who some time about the year 1896 proposed to vest in trustees properties to the capital value of thirty lakhs of rupees, for the purpose of endowing a Research Institute for India.

In the course of the years 1900 and 1901, Mr. Tata's proposals were examined and reported upon by Sir William Ramsay, and subsequently by Professor (now Sir David) Orme Masson and Col. Clibborn. In the meantime, the Government of Mysore had offered, through the late Sir Sheshadri Iyer, to place a site of 371 acres in Bangalore at the disposal of the future governing body of the Institute, and to contribute the sum of five lakhs of rupees towards initial expenses, subsequently making an annual subsidy of Rs. 50,000 without limit of time. The Government of India undertook simultaneously to make an annual grant of Rs. 30,000 (subsequently increased to Rs. 1,50,000), and it appeared as if the Institute could be brought into existence without further delay, when on May 19th, 1904, Mr. J. N. Tata died while on a visit to Europe.

Sir Dorabji J. Tata and the late Sir R. J. Tata at once announced their intention of giving effect to their late father's wishes. They immediately proceeded to take such steps as were necessary to complete the arrangements for transfer of the endowment to the Treasurer of Charitable Endowments for Bombay; and Dr. Morris W. Travers, F.R.S., who was appointed Director in August, 1906, proceeded with the work of maturing a scheme for the organisation of the Institute,

in consultation with the Government of India, the Government of His Highness the Maharaja of Mysore, Sir D. J. Tata and the late Sir R. J. Tata.

The first students were admitted to the Departments of General Chemistry, Applied Chemistry, and Electrical Technology on July 24th, 1911, the Department of Organic Chemistry being opened in September of the same year. In 1914, in order to facilitate administration, the Departments of General Chemistry and Organic Chemistry were amalgamated. During 1921, owing to the functions of the Department of Applied Chemistry having been gradually assimilated to those of the Department of General and Organic Chemistry, a new Department of Bio-Chemistry was inaugurated, in recognition of the numerous economic problems peculiar to India, which naturally group themselves in this branch of knowledge. The brief term which has elapsed since the laboratories were made ready for the reception of students, roughly twelve years, has been fruitful of substantial results, which are best reviewed in association with the departments producing them.

Early in the history of the Institute attention was drawn to the possibility of utilising, in India, the sandalwood trees of Mysore. The essential oil, obtained by distilling the finely-divided wood in a current of steam, is highly valued in perfumery, and also finds medicinal application, but although India is the principal source of the wood, extraction of the oil formerly took place almost exclusively in European factories. Arising directly from experiments conducted at the Institute, two sandalwood-oil factories have been successfully established by the Government of Mysore, and incidentally the experience gained has led to marked improvement in the general methods of distilling essential oils as practised throughout the Indian peninsula. A process has been elaborated for the manufacture of high-grade thymol crystals from Ajowan seed without the use of solvents, and stills suitable for obtaining high-grade oils from dark-coloured, country-distilled oils have been introduced into several factories.

Another useful, although perhaps less spectacular, outcome of experimental work in the Department of General and Organic Chemistry is the elaboration of a process for the manufacture of white lead, now extended to the commercial scale in Bangalore. Equally practical inquiries into the utilisation of local oils for soap manufacture have led to the foundation of a factory in Bangalore, where high-class soaps are produced under the auspices of the Government of Mysore ; and experiments on the composition of lead-pencils have resulted in the manufacture of these articles in Madras. Thus five factories in active operation are directly traceable to the work of the chemical staff and students working in the laboratories of the Institute.

In connection with wood-distillation, experiments have been made with more than forty different species of woods from the forests of Mysore and Baroda, with the object of ascertaining the yields of bye-products obtainable from the woods on destructive distillation ; the results have rendered valuable assistance to the Mysore Distillation and Iron Works at Bhadravati.

An exhaustive examination of the methods for isolating caffeine from tea-fluff and tea-waste has been made ; inquiry into improvements of common methods for refining Indian saltpetre, and the possibility of manufacturing tartaric acid from tamarinds, has been conducted. The production of sodium dichromate from Indian chromite has been investigated, with the result that satisfactory yields of this material, indispensable to the chrome-tanning and other industries, have been obtained. A process, suited to Indian conditions, for the manufacture of sodium thiosulphate has been elaborated. Work on fixed oils has comprised experiments on refining and hardening, the production of ghee-substitutes, determination of the composition of some less well known oils, and an examination of the relation between the iodine-values and refractive indices of hardened oils.

In a manner resembling that outlined in the preceding paragraphs, the Department of Applied Chemistry,

and subsequently that of Bio-Chemistry, may be correlated with definite economic advantages to India. A wide question occupying the Department is that of sewage disposal and the conservation of nitrogen, regarded by competent authorities as being fundamental to the successful prosecution of that venerable industry which is destined to remain the paramount factor in the prosperity of India, namely, agriculture. The rapidly increasing demands of Jamshedpur have been largely met by a system of sewage-treatment and water-supply based on advice proceeding from the Institute; a well-equipped laboratory for the necessary bacteriological and chemical work is conducted by former students of the Institute, whilst other former students are engaged in the scientific control of waterworks construction and operation at Delhi and at Shanghai. Meanwhile, principles underlying the bacterial and chemical changes involved in the effects of activated sludge are being pursued in the Department of Bio-Chemistry, one definite outcome of which has been a marked improvement in the production of vinegar, whilst the application of the material itself as a fertiliser has led to remarkable results at Jamshedpur.

Experiments in the same Department led to the preparation of varnishes from poppy, linseed and tung oils, whilst a practical method of utilising the oleo-resin from *Boswellia serrata* now awaits development. An attempt to utilise a material which otherwise goes to waste, relates to the generation of marsh-gas by the fermentation of cellulose, with the object of obtaining power from the gas thus evolved in districts where vegetation is abundant but fuel is costly. An allied subject, which has received continuous attention in the Institute laboratories, is the production of power alcohol, the possibilities of "megasse," "mahua," prickly pear and other forms of waste-carbohydrate as potential sources of liquid fuel having been closely examined. Finally, students have been trained in the cultivation of lac, the study of the habits and requirements of the lac-insect, the recognition of its parasites, and the preparation

of the resin, dye and wax for the market; these experiments have been conducted at the request of the Government of Mysore, and a considerable area of suitable trees for the propagation of the lac-insects has been placed at the disposal of the Institute a few miles from Bangalore.

Turning now to the Department of Electrical Technology, results which place themselves in a somewhat different category deserve to be recorded. At the period when the Institute was founded, none of the establishments devoted to higher education in India offered a course of training which fitted students to assume positions of responsibility as electrical engineers. That reproach has now been removed by the classes conducted during the past twelve years at the Indian Institute of Science, and many of its former students are now to be found in active control of the numerous hydro-electric and other power-generating schemes dispersed throughout the peninsula. Thus a very definite Indian requirement has been confronted and satisfied by the Institution, endowed in so far-sighted a manner by the late Mr. J. N. Tata, and it is no longer necessary for young Indians, whose ambition lies in the direction of assisting to develop the waterpower of their own country, to seek European facilities for their professional training. The need for providing such routine training at the Institute has diminished the opportunities of the Department to produce original work in such large volume as that laid to the credit of the Departments of General and Organic Chemistry and of Bio-Chemistry, but for the reason stated above the achievement of the Department of Electrical Technology has fully justified the foundation of that branch of the Institute's activities.

Although the preceding paragraphs have emphasised the contribution made by the Institute to the preparation of post-graduate Indians for industrial careers demanding a knowledge of scientific principles and methods, it is proper to emphasise the fact that there has been carried on in the laboratories much scientific work

which has not met the eye of the public, and which appeals only to a purely scientific audience. This is incorporated, along with technical details relating to the industrial inquiries, in the Journal of the Institute, which has now attained to more than eighty separate issues, appearing in most cases under the joint authorship of the respective professor and the students collaborating with him. The subjects covered by these researches include: Borohydrates; Radioactivity of Kolar Rocks; Determination of Vapour-Pressures; Experiments on Kathode Fall; Absorption of Gases by Quartz at Low Temperatures; Reduction of Barium Sulphate in the presence of Magnesium Chloride; Esterification, Alcoholysis and Acidolysis; Magnesium Chloride; Halogenated Cinnamic Acids; Behaviour of Chromates at High Temperatures; Replacement of Sulphonic Acid Groups; Examination of Essential Oils and Drugs from Indigenous Plants. Work of this nature affords the best possible preparation for the post-graduate student who desires to embark on an industrial inquiry, and it is consequently the policy of the Council to encourage it, although the influence it bears on the improvement of industrial processes may not be obvious, and is, in some cases, remote. In addition to the foregoing advantages, the students have uninterrupted access to a very fine library which, so far as scientific publications are concerned, is not excelled in the country; the hostel provides them with necessary residential accommodation within the limits of the Institute estate, whilst tennis courts with cricket ground supply them with facilities for athletics. During the session 1922-23, the number in attendance was 100.

In conclusion, it is proper to state that the topographical situation of the Institute is delightful. It has to be regretfully recognised that in India, owing to the great distances which separate the large cities and the centres of industry, it is not practicable to secure that frequent personal association between workers in the several fields of intellectual activity which prevails in European countries and in the United States. Con-

sequently, in selecting a site for the Indian Institute of Science, more weight was given to climatic conditions than to the possibility of approximating it to a great city or a centre of industry. Thus the chosen location is probably the most favourable which could have been found in India, since it is possible to work there without undue discomfort during the greater part of the year; situated about three miles from Bangalore, it enjoys an elevation of 3,050 feet, and more than 200 acres of the land originally granted have been already converted to the construction of laboratories, the hostel for students, and bungalows for the teaching staff. These buildings are disposed along three sides of a rectangular *maidan*, which is dominated by a very handsome central building in grey granite, containing the library, offices and council chamber, and crowned by an imposing tower, one hundred and sixty feet in height. Fifty yards from the main entrance there stands a beautiful monument, the central feature of which is a noble statue of the late Mr. J. N. Tata, unveiled by His Highness the Maharaja of Mysore on March 10th, 1922. A memorial tablet bears the following inscription:

JAMSETJI NUSSERVANJI TATA
PARSI CITIZEN OF BOMBAY
BORN MARCH 3, 1839
DIED MAY 19, 1904.
TO HIS FORESIGHT AND PATRIOTISM
THE INDIAN INSTITUTE OF SCIENCE
BANGALORE OWES ITS ORIGIN
AND TO HIS MUNIFICENCE
A GREAT PART OF ITS ENDOWMENT.
AS A DISTINGUISHED
CAPTAIN OF INDUSTRY
AND PATRON OF LEARNING
HE PERCEIVED THE BENEFITS
TO HIS COUNTRY

OF ADVANCED RESEARCH IN
SCIENCE, ARTS AND INDUSTRIES
AND FOUNDED THIS INSTITUTE
THE FIRST OF ITS KIND IN INDIA.
THIS STATUE
OF ITS FOUNDER
WAS ERECTED IN 1916
BY
THE COUNCIL OF THE INDIAN
INSTITUTE OF SCIENCE.

Thus, in sweet and peaceful surroundings, which the great Indian unhappily did not live to see, his bronze embodiment stands for all time, giving daily inspiration to those eager students who may pass it on their way to the sources of learning which his far-sighted munificence created.

M. O. FORSTER.

INDUSTRIES IN MYSORE

UNTIL about a decade ago the bulk of the population engaged in industrial occupations consisted of artisans who pursued their profession in their own cottages. The most important cottage industry was weaving. The Mysore weaver was specially noted for his skill in weaving silk and woollen fabrics and also cotton of superior counts. Oil pressing was also another important industry, carried on with the aid of the indigenous ghanas. In artistic industries, such as carved and inlaid work, embroidery, lacquer work, brass metal work, and carpet manufacture, the work of the Mysore artisan had attained a high standard and wide renown.

Some ten years ago there were few factories carrying on manufactures on a large scale. The Kolar Gold Fields and the Cauvery Power Scheme were two of the biggest industrial enterprises. Manganese was being extracted on a fairly large scale in the Shimoga District. The other factories were two cotton mills and one tile factory in Bangalore, two coffee curing works at Hunsur, two rice mills in Mysore, one rice mill at Alur (Hassan District), and eight ginning factories and three presses at Davangere.

During the last ten or twelve years there has been a rapid development of industries in the Mysore State. The main causes for this are:

(1) The special measures adopted, under the direction of His Highness the Maharajah, for the encouragement of industries by the organisation of the Mysore Economic Conference and the founding of the new Department of Industries and Commerce.

(2) The grant of financial and technical assistance to the new industries through the agency of the Department of Industries and Commerce.

(3) The special facilities provided for training Mysoreans in industries by the provision of a generous system of technical and research scholarships in India and abroad.

(4) The starting of pioneer and demonstration factories under the control of the Department of Industries and Commerce.

(5) The availability of cheap electric power. The generating station at Sivasamudram now produces annually more than 10¼ crores of units. The chief consumers of power in the State are the Kolar Gold Fields, the cotton and woollen mills in Bangalore and Mysore, and a number of small factories in the same two cities. A portion of the power is used for lighting the cities of Mysore and Bangalore. The supply of electric power is far short of the demand, and the Electric Department has on hand the problem of increasing the power generated.

RAW MATERIALS

The principal raw materials found in the State suitable for manufacturing purposes are iron ore, chrome, manganese, asbestos, mica, corundum, magnesite, kaolin, etc., and textile fibres, such as cotton, silk, wool, oil seeds, sugar cane, tobacco, timber, and a number of minor forest products, such as lac, tanning materials, etc.

MINERAL INDUSTRIES

Gold is extracted at Kolar. The total gold produced during 1922-23 amounted to 4,23,348 ounces, valued at Rs. 2,58,63,000. Charcoal pig iron is produced at Bhadravati, the annual production of the same being between 15 to 20 thousand tons per annum. (It is convenient to mention here that the charcoal required for the blast furnace is produced on the spot by the destructive distillation of wood. Mysore is the largest and the only producer in India of methyl alcohol and the grey acetate of lime.)

The total quantities of chrome and manganese exported in 1922-23 amounted to 9·58 and 24·92 lakhs of maunds respectively. Recently a well-equipped factory has been established in Mysore to produce asbestos mill boards and boiler compositions of very high quality. There are two factories in the State specialising in manfacturing kaolin products, such as fire brick, flooring tiles, sanitary pipes, etc. There is a factory working at Kolar Gold Fields for the manufacture of refractory materials from the cyanide dust.

There is a large number of factories in all parts of the State for the manufacture of ordinary bricks and "Mangalore tiles."

OIL INDUSTRIES

The total quantity of oil seeds of different kinds, including copra, exported every year out of the State comes to nearly seven lakhs of maunds, valued at nearly a crore of rupees. Only a small proportion of the available quantity is crushed by means of the country ghanas. Recently, under the help and advice of the Department of Industries and Commerce, five Anderson Expellers have been installed, producing about ten tons of oil per day. This type of expeller is not suited to all kinds of seeds. The Department is watching the results very carefully, since a large extension of the oil pressing industry will automatically make oil cake available for cattle feeding and manuring, which are of vital agricultural importance to the State. A small hydraulic press, producing half a ton of oil per day, is in the course of yielding good results. The improvement in the rotary ghana, so common on the Malabar Coast, to suit the local conditions, is being investigated by the Department of Industries. Owing to some local difficulties, a fairly large oil extraction plant by the solvent process has not been able to start working, even though the installation is complete. The scope for improvement of the oil pressing industry is very great, and the Department is specially interested in the prob-

lem. In this connection mention must be made of the experiments conducted at the Indian Institute of Science on the hydrogenation of oils. The results of a small semi-commercial hydrogenation plant at the Institute are awaited with great interest.

It is convenient to mention here some of the industries connected with the oils and fats. There is a small factory in Mysore producing fairly good candles. There is a paint factory in Bangalore City, and also a white lead factory. The Government have successfully pioneered a soap factory, whose high quality soaps are very popular in Southern India. There are over a dozen small soap factories, preparing country soaps that readily sell in the bazaars on account of their cheapness.

ESSENTIAL OILS

Two factories have been established by the Government, one in Bangalore and the other in Mysore, to manufacture sandalwood oil. The factories are able to distil annually 150,000 to 200,000 pounds of sandalwood oil, valued at about twenty-five to thirty lakhs of rupees. There is a large essential oil factory in Mysore, which is the result of work of a private syndicate. This factory prepares the following oils in a state of very high purity: Cinnamon leaf, clove, patchouli, vetivert, rosha grass, ajwan, cardamom, ambrette seed, etc. The factory also produces natural isolates, the chief amongst which is thymol.

TEXTILE INDUSTRIES

Silk. The value of raw silk produced in the State is about a crore and a half rupees; in addition to the above about twenty-five lakhs of rupees worth of silk waste is produced. In connection with the production of silk, mention must be made that there are nearly 40,000 acres of land under mulberry cultivation.

About one-third of the raw silk produced in the State is utilised by the local weavers, and the surplus is ex-

ported to the Madras Presidency. The silk waste is now entirely exported to foreign countries, chiefly Italy, where it is cleaned and spun, and brought back to India as spun silk. The cocoons are now reeled according to indigenous methods. The silk produced is not sufficiently even and uniform to meet the requirements of the foreign markets. Government have recently established a filature in Mysore by importing machinery from France. It has been proved that the margin of profit between filature-reeling and indigenous reeling comes to nearly 20 to 30 per cent. of the actual price of silk. Arrangements are being made to start these filatures on a large scale, and also to introduce suitable throwing machinery to enable the indigenous weaver to use the silk on his loom. One immediate result of opening a large foreign market for Mysore silk would be a great extension of the area under mulberry cultivation, for which conditions are ideally suitable in various parts of the State. The Government have also adopted special measures to increase the supply of disease-free seed to the silk-worm rearers, by starting "grainages," and have employed experts to carry on investigations for improving the breed of silkworms and checking disease.

Cotton. The total area in the State under cotton averages 1,15,000 acres. Cotton grown is of two classses—Dodhatti, which is a variety of the American uplands, and Sannahatti, well known in the market as Dharwar Kumtas. The total number of weavers in the State is about 52,000, and about 60 per cent. of these, especially those belonging to the Depressed Classes, are engaged in weaving very coarse counts ; the rest manufacture fabrics of superior counts. The use of fly-shuttle slays was demonstrated by the Department of Industries and Commerce some ten years ago, and nearly 35 per cent. of the looms in the State have the fly-shuttle attachment. The chief difficulty of the weaver is in producing sized warps and yarns required by him, as he is not able to purchase the preparatory machinery required, and there are no factories in the

State specialising in such work. There is a Government Weaving Factory, whose main functions are to train the weavers in the use of improved appliances and machines, to carry on experiments and introduce new designs and patterns, and manufacture machines suited to the cottage weavers, and demonstrate them on a commercial scale The Department has designed a new warping and sizing machine and a complete collection of machinery suitable for the hand-loom weavers, such as pirn and bobbin winding machines, silk twisting machine, etc. These machines obtained a special prize at the Patna Exhibition. The use of the jacquard on hand looms, cheese winding machines, etc., is also engaging the attention of the Department.

Another important line of development that the Department has introduced is the use of power looms in small factories, taking advantage of the availability of cheap power in Bangalore and Mysore. It has been demonstrated that a factory equipped with about six looms may be worked with considerable profit, which increases in a much higher proportion if the output is increased. So far there are four power loom factories, and it is estimated that nearly a hundred such looms will be at work within the next few years. The development of small handloom factories has also received special attention of this Department, and eight such factories are at work in various parts of the State. The remarkable development of cotton mills in the State has already been referred to. The mills in operation and those under erection will contain nearly 1,25,000 spindles and 2,000 looms, as against 4,000 spindles and 800 looms only a few years ago. As there is not much direct competition between the fabrics manufactured by the mills and the handloom weavers, the increase in the number of mills has not, to any great extent, affected the handloom weavers. The exports of manufactured textile goods from the State continue steadily to increase, while there is a corresponding decrease in the exports of raw materials.

Woollen Mills. In the spite of the large number of

people engaged in the State in the weaving of indigenous blankets, rugs and carpets, large quantities of wool used to be exported from the State. The Department arranged to supply army blankets during the War by getting them manufactured by the local weavers on fly-shuttle looms. This resulted in a remarkable development of industry since the War. Two more woollen mills have been established as joint stock companies, besides the expansion of the Bangalore Woollen, Cotton and Silk Mills. Another small woollen mill, owned by a private gentleman, has been equipped with additional machinery. It is proposed to manufacture in this mill all kinds of fabrics to which Indian wool is suited. The Department is also engaged in introducing labour-saving methods amongst the cottage woollen weavers, and is helping them to obtain supplies of yarn and to get the goods milled. Arrangements are also being made to manufacture tweeds, light-weight rugs, and shawls. The carpet industry has been revived, and, besides, the Jail carpets are now manufactured on a large scale in several private concerns. The woollen industry is likely to be one of the most important industries in the State in future.

Sisal Hemp. Sisal hemp has been grown successfully in various parts of the State, for which the climate and other conditions seem particularly suitable. About 1,000 acres have been planted with sisal hemp, and the quality and yield of fibres has been found very satisfactory. There are many forest and other fibres in the State which can be used for industrial purposes.

JAGGERY AND SUGAR MANUFACTURE

The total area under sugarcane in the State ranges between 35 to 40 thousand acres. It is now grown in small patches of land, and is converted into jaggery by being crushed in small three-roller iron mills. The total quantity and value of jaggery exported out of the State in 1921-22 was estimated at 1,70,737 maunds and 19·49 lakhs of rupees. The Department of Industries

has introduced a power plant for the extraction of the juice, and an improved triple furnace for boiling the juice into jaggery. The plant is now being worked successfully at Chennarayapatna. A steam heating plant was also tried last year, but the results, though encouraging, have not yet yielded sufficient data regarding the cost of working, etc., of the plant. The chief difficulty in the way of starting sugarcane factories in the State is that the land suitable for such purposes is already under occupation, and that it is not easy to get sufficiently large blocks of land in new areas where the cost of bringing such lands into cultivation, owing to scarcity of population and other causes, would be excessive. There are, however, localities in the State where by proper organisation such factories can be started, and the matter is receiving attention.

FOREST INDUSTRIES

The value of the timber sold by the forest Department annually is about nine lakhs of rupees. There are nearly 75 varieties of timber in the Mysore forests, many of which are suited for high-class furniture and other ornamental work. The Government have started an Arts Workshop, chiefly with a view to train local people in the manufacture of high-class furniture and to popularise the less-known varieties of timber. A large number of artisans have also been trained in sandalwood and other wood carving and ivory-inlaid work. A large factory, with a capital of about five lakhs of rupees, has recently been started in Bangalore for the manufacture of furniture and art-ware.

Mysore is also rich in tanning materials and natural dye stuffs. The tanning materials are either used in the bark tanneries established near Bangalore or are exported.

Lac is a minor product of the Mysore forests, the possibilities of which have yet to be adequately developed. Special measures have been adopted, not only to increase the supply of lac, but also to introduce better

methods of cleaning and washing. Experiments regarding the utilisation of lac locally are in progress. A small factory has been established for the manufacture of button-lac and shellac. Excellent progress has been made in the manufacture of lacquer-ware by the use of power-driven machinery.

MATCH FACTORIES

Investigations made show that, in the forests of Shimoga and Kadur Districts, about 20 varieties of soft woods suited to the manufacture of matches and match boxes are available, and the parts of the forests in which they are found possess many advantages to allow of such woods being extracted in sufficient quantities for two or three large factories at a moderate cost. Concessions have been offered by Government for the development of this industry, and steps are being taken to start a joint stock company for the purpose.

HIDES AND SKINS

Owing to the abundance of tanning materials in the State and peculiar suitability of the water near Bangalore for tanning purposes, Bangalore has from time immemorial been the centre of the tanning industry in Southern India, and chiefly half-tanned hides are turned out. The total quantities of hides and skins exported from the State average annually 96,000 maunds, valued at nearly 38 lakhs of rupees. The total number of private bark tanneries in Bangalore is 16, and about four of them carry on operations on a large scale. The business is in the hands of the Labbe merchants, who have established an organisation to collect the hides from every village in the State.

The first chrome tannery started by private enterprise in Southern India was in Bangalore in the year 1908. The tannery is now equipped to turn out 120,000 feet of finished leathers per month.

COFFEE, TEA AND RUBBER

Coffee is a commercial crop of the greatest importance in the State. It is grown chiefly on the elevated hill sides of the Kadur and Hassan Districts, about 3,000 feet above the sea level. The total acreage under coffee is nearly 1,00,000 of acres, and the value of the crop ranges between a crore and a crore and a half of rupees. Mysore coffee is noted for its superiority and flavour, and is equal in quality to Arabian coffee, which is usually mixed with it. Coffee is either sent powdered or as pulper coffee, the former being in demand in India and the continental market, and the latter in England.

Tea is grown only on a very small scale in the State over about 200 acres, but there is an abundance of suitable land.

Rubber is grown to a small extent, but the yield is poor.

Fruit grows profusely in various parts of the State, but there is only a single canning factory at present.

Among other commercial crops tobacco is the most important, but though the manufacture of cigarettes is an important industry, the bulk of the tobacco is either locally consumed or exported to neighbouring parts of India for being chewed with pan.

The first kinds of superior areca nut are also produced in the State. The total area under *supari* is about 38,000 acres, and the total value of the export trade in areca nut in 1921-22 amounted to 48·95 lakhs of rupees.

FACTORIES FOR TRAINING PEOPLE IN INDUSTRIES

There is an Engineering School and College for the training of the people in engineering in all its branches. The existence of the Cauvery Power Works, the workshops maintained by the Department of Industries and the railways, and the large factories established in the State afford ample facilities for practical training, which

is encouraged by a liberal reward of scholarships by Government. In every district headquarters there is an industrial school, either Government or aided, in which elementary instruction is imparted in the ordinary industries, such as carpentry, blacksmith's work, care of oil, gas and other engines, rattan work, etc. In addition to these, there are three trades schools, *viz.* one for training in carved work, another for training in lacquer ware, and the third for training in weaving. The Chamarajendra Technical Institute, at Mysore, provides training in all the important arts and crafts pursued in the State. For instruction in courses not provided for in the State, a system of scholarships has been instituted, and about twelve students are under training outside the State. A certain number of State scholars work in the Indian Institute of Science. In the award of foreign scholarships, preference is given to industrial and technical subjects.

CONCLUSION

The State has abundant resources for the development of many new industries, but owing to lack of capital, absence of a sufficient number of organisers, and want of adequate facilities for systematic investigation and research, the progress, though noteworthy, is still somewhat slow, but the successful results attained by many of the new ventures is likely to afford the necessary impetus for a more rapid development of industries in the future.

P. G. D'SOUZA.

CAUVERY FALLS POWER SCHEME

THE story of power development at the Cauvery falls in Mysore is not a new one, but its interest is no less lasting than Nature's work itself, which has not ceased to tempt travellers to new descriptions of their beauties. Started in 1902 as the first long-distance transmission hydro-electric system in India, the Cauvery Power Scheme continues to have many novel features in its later developments of plant design and apparatus. The rapid growth of power-consuming industries, and the increasing popularity of Mysore as a centre of power, have, however, become the features of chief interest in these days of a universal demand for fuel conservation. They serve to show how close co-operation between the State, the industries, and the community at large can help to exploit the water-power resources to the greatest benefit of all interests.

The scheme was first started as a development of the minimum flow in the river, which was known to be in some years less than 100 cusecs, and in normal years 250 cusecs, during the hot weather A diversion dam, averaging 8 ft. high, and 2,300 ft. long, with the usual head-gates, was constructed across the river at the top of the rapids above the falls. From the head-gates two parallel canals, 17,960 ft. long, each with a capacity of 275 cusecs, were constructed, to lead the water to the top of the Bluff overlooking the Generating Station, situated three-quarters of a mile below the falls, giving a gross head of 406 ft. between forebay water level and centre line of turbine shaft, as compared with a head of 250 ft. at the falls. Three 45" diameter rivetted steel penstocks, about 900 ft. long, were used to take water from the forebay to six 1,200 b.h.p. impulse turbines direct connected to 750 k.w. generators operating at

25 cycles. The generator pressure was stepped-up to 35,000 volts for transmission over duplicate 3-phase transmission lines to the Kolar Gold Fields, 92 miles distant, where the voltage was reduced to 2,200 volts for distribution to the Mining Companies' motors.

The entire plant was designed to deliver 5,000 h.p. continuously at the terminals of the motors. No storage was provided to augment the minimum flow in the river; consequently, the Mining Companies, the only consumers at that time, had to maintain in good working order their steam plant ready to start up when the flow in the river was less than that required to deliver the full 5,000 h.p.

The Cauvery power, to the extent of 5,000 b.h.p., was first used by the mines for operating air compressors, rock-crushers, tube-mills, pumps and repair shops, the remainder of their power requirements being met by their existing steam plant. Operation, even under these conditions, was so economical that a second installation was undertaken and completed in 1904 by the addition of five 1000 e.h.p. units and corresponding transformer equipment. The shortage of water in the river during the dry season for the additional load of 5,000 h.p. was being made up by temporary conservancy works at several low-level anicuts on the river above the falls. The head-works diversion dam and several low-head irrigation dams up the river were raised about 4 ft. each year by means of sandbags, which, except in years of extreme drought, provided sufficient storage to maintain the full power supply.

The extension of the transmission system to Bangalore City in 1906, for the supply of lighting and general industrial power, was a step that has perhaps contributed more than any other factor to the present industrial position of the State, and the outstanding part in it of the hydro-electric power scheme. A 57-mile double-circuit, 35,000 volt, 3-phase, transmission line, and a main receiving station, were put into service in 1907 for supplying power in Bangalore.

The increase of load at the mines and in Bangalore led to the third installation at Sivasamudram in 1907, which consisted of a 2,000 e.h.p. generating unit. A third 3-phase transmission line to the mines was added, to enable the delivery of power up to 10,000 e.h.p. at the motor terminals. A 37-mile double-circuit, 3-phase, 22,000 volt transmission line was also built, to provide a lighting and power service in Mysore City, the capital of the State. In 1914 the generating plant capacity was 14,650 h.p., the maximum load on the system was 15,300 h.p., and the capital cost of the entire plant, including the distribution systems of Bangalore and Mysore cities, stood at Rs. 83 lakhs.

Within 12 years of first starting, the reliability and convenience of the power service had been so thoroughly demonstrated that the development had reached the maximum capacity possible without costly and permanent storage works. Electrification was proceeding rapidly on the mines, and was being extended to the winders. In Bangalore and Mysore cities, the small industrial motors and the lighting loads were rapidly increasing, as well as the large consumers of power, such as cotton mills, pumping stations, railway workshops, etc. Having reached more than three times the capacity corresponding to the minimum flow of 250 cusecs, the reputation of the power service was beginning to be jeopardised. A storage dam was, therefore, undertaken at Krishnarajasagara, about 65 miles above Sivasamudram, in 1912, and its first stage, 80 ft., completed in 1920, provides a storage capacity of 11,000 million cub. ft., which is sufficient to maintain a minimum flow of 900 cusecs in the power canals at Sivasamudram. During the construction of the dam up to this height, the annual increase in the storage in the reservoir was sufficient to meet the annual increase of water requirements at the power station.

Along with the storage works at Krishnarajasagara, extensions to the power station, known as the IV installation, were undertaken, and finished in 1915. This extension consisted of the addition of 2 impulse turbine-

driven generating units of 2,000 e.h.p., and the raising of the mines transmission voltage to 70,000 volts by constructing two of the 3-phase lines, using 4-disc suspension insulator strings. Nine 1,750 k.v.a. oil-insulated and water-cooled single-phase transformers were used at both ends of the 70 k.v. lines. The transmission line losses after the change-over from 35 k.v. to 70 k.v. was effected were greatly diminished, with the result that less power was supplied to the Kolar lines in that year than the previous year, although the mines consumed more power. It is noticeable that after 1915, the year when storage in the Krishnaraja-sagara Reservoir was first available, there has been no diminution in the power supply on account of water shortage.

The Mysore transmission voltage was raised to 35,000 volts in 1920, so that both Mysore and Bangalore loads could be served by the same 35,000 volt transformers. In 1917 the generating capacity was increased by another 4,000 e.h.p. by the completion of the first high-head Francis Turbine installation in India, *viz.* a 5,600 b.h.p., 500 r.p.m., horizontal single discharge reaction turbine, direct coupled to a 3,000 k.w. generator. By the addition of the latter unit, or what is known as the V installation, the plant capacity was raised to 22,650 e.h.p.

Guaranteeing the hot weather flow in the river by the storage works at Krishnarajasagara has encouraged the mines to proceed confidently with electrification, which is now being largely applied to the winders. On account of the continual increase of working depths, which in several shafts has reached 6,000 ft., their power requirements are growing rapidly, until at present approximately 20,000 h.p. has been contracted for. Power demands in Bangalore and Mysore cities have also been increasing rapidly. The further development of hydro-electric power became, therefore, a question of allocating the storage at the Krishnarajasagara between the industrial and agricultural demands of the country to the greatest benefit of all concerned.

Co-ordinating the water-claims of agriculture and power will perhaps be the chief feature of most hydro-electric developments in a pre-eminently agricultural country like India. After due consideration of all interests, the Mysore Government have decided to allocate for power purposes a minimum continuous flow of 900 cusecs at Sivasamudram. Extensions and re-modelling of the entire plant, known as the VI installation, are now in progress at Sivasamudram, to utilize the 900 cusecs in the most efficient manner.

The eleven 1,150 e.h.p. impulse turbine units will be replaced by six 4,000 e.h.p. Francis Turbine driven units, similar to that of the V installation. Apart from the improved efficiency of the larger machines of modern design, the gross head is increased from 406 ft. to 424 ft., by reason of the drought-tube effect. The 5,600 b.h.p. turbines are the manufacture of Messrs. Boving & Co., Ld., London, and have a guaranteed efficiency of 85 per cent. at full load, as compared with an efficiency of about 63 per cent. that is now obtained with the old units. Six 55" diameter rivetted steel pen-stocks are being installed, in place of the old and smaller pipe lines, to supply these new 5,600 b.h.p. units. The first four pipe lines have been already received, and were made in Scotland and supplied by Messrs. Glenfield & Kennedy. Retaining the generating units of the third, fourth and fifth installations, the plant capacity of the station, after the completion of the VI installation, will be 34,000 e.h.p. for developing 32,000 e.h.p. with the 900 cusecs, at an over-all plant efficiency of 75 per cent. During the IV installation, the capacity of the power channels was increased to a total of 1,000 cusecs ; no further alteration to the duct system has, therefore, been necessary, beyond the enlarging of the forebay spill-way and the modification of the forebay chambers to take off the new pipes.

A novel feature of the plant at Sivasamudram, as originally designed, was the location of the transformer station at the top of the Bluff, using first 3-core, lead-covered cables, and later bare copper busbars were used

to connect the generators to the step-up transformers. These busses are 4 sq. in. in section, and the total weight of copper used in them is 75,000 pounds. These cables and busses were housed in a 900 ft. long totally-covered duct going up the hill. This feature, originally designed with a view of keeping the minimum number of operators in the generating station, became a source of considerable expense, and even insecurity of service, as the capacity of the plant increased. It was manifestly uneconomical to transmit large blocks of power up the hill side at the low generator pressure of 2,200 volts by means of bare copper busbars. A new transformer station has, therefore, been built alongside the turbine-room, and the design provides for duplicate high and low tension busses; 5 banks of 1,750 k.v.a. single-phase, water-cooled transformers will be installed and provision made for operating all the three transmission systems at 70,000 volts. In accordance with modern practice, the neutral of the h.t. systems will be directly grounded at Sivasamudram.

Reference may be made here to the remodellings and extensions of transmission lines and receiving stations necessary to distribute the increased power made available at Sivasamudram. A new receiving station with a capacity of 10,000 h.p. was completed and put into service in Bangalore, in 1920. It is now proposed to correspondingly increase the Bangalore transmission lines capacity to 10,000 h.p. The work will consist of stringing a third 70,000 volt, 3-phase, 25-mile transmission line between Sivasamudram and Kankanhally, providing 3-phase circuits to transmit thereto the combined load of Bangalore and the mines. Water-cooled auto-transformers will be installed at the new transformer and switching station at Kankanhally to step-down the pressure from 70 k.v. to 35 k.v. for feeding the Bangalore transmission lines. It is also proposed to build a double-circuit, 3-phase, 70 k.v. transmission line to Mysore and a new receiving station of 6,000 h.p. capacity.

Considering the favourable conditions in the State

as regards labour and transportation, the growth of the textile industry alone would be enough in the next few years to tax the resources of the Cauvery power development at Sivasamudram. Power demands from other quarters, besides, have not been slow. City water supply systems, railway workshops, and the small industrial installations have an aggregate demand at present of 2,500 h.p. and admit of considerable extensions. The demand at Sivasamudram due to power applications now before the Government is already 2,000 h.p. in excess of the plant capacity as it will be after the VI installation is completed.

Included in the industries served with electric power and light, are oil mills, cotton and woollen mills, ice plants, tobacco factories, flour mills, and so on, to every industry included in the industrial development of those parts of the State reached by the supply lines, which are gradually being extended to the smaller towns along the transmission lines. By the electrification of these several industries, the consumption of more than 100 tons of fuel per day has been stopped, helping to reduce the cost of fuel for domestic purposes, and to conserve the inadequate fuel resources of the State.

S. G. FORBES.

KOLAR GOLD FIELD

(A Short History, with Acknowledgments to B. Lewis Rice's "Mysore Gazetteer.")

The Gold Field is situated in the south of the Bowringpet Taluq of the Kolar District, Mysore State, to the east of a low ridge of hills, of which Betarayan Hill, 3,199 feet above sea level, is the most conspicuous point.

The existence of the remains of old workings had long been known, but it was not till 1873 that any special attention was directed to them. In that year Mr. M. F. Lavelle, a resident in Bangalore, applied to the Mysore Government for the exclusive privilege of mining in the Kolar District. His request having been granted, he commenced operations by sinking a shaft near Urigam (Oorgaum) in 1875, but, finding that large capital would be required for carrying out the work, he, in the following year, with the approval of the Government, transferred all his rights and concessions to the late Major-General G. de la Poer Beresford. This officer, with some friends, formed a syndicate known as the Kolar Concessionaires (since merged into the Gold Fields of Mysore Co.), who took up the matter in earnest, and acquired from time to time the area known as the Kolar Gold Field.

By 1880 the Concessionaires had secured the aid of Messrs. John Taylor & Sons, mining engineers of London, and in February of that year Capt. B. D. Plummer was sent out to commence operations in the Nundydroog Mine. These were continued until April, 1883, when work was suspended. The results of some trial crushings were, however, considered by Capt. Plummer to be so favourable that he strongly urged a

continuance of operations, but the shareholders hesitated to venture more capital in the concern. Meanwhile, the Mysore Company had also come nearly to the end of their resources. A balance of only £13,000 remained, and it was a question whether to divide this amongst the shareholders or to risk it in further development. The strong advice of Mr. John Taylor and a few other gentlemen prevailed, and Capt. Plummer was again sent out in December, 1883, to the Mysore Mine, to do the best he could with the amount available. There were very few persons at that time who retained any faith in the future of Indian gold mining, and he was considered to be engaged in a lost cause. What actually occurred is matter of history. The "Champion" lode, which had previously been thought to have cut out, was found to persist in depth, and by 1885 the success of the Kolar Gold Field was established. In March, 1885, the Nundydroog Mine was again started, and the Balaghat and Ooregum Mines soon followed. The whole Field was roused into activity, and shortly, in what was a desolate waste, a large and flourishing town sprang up, provided with most of the conveniences and institutions of European life.

The industry has enjoyed the active support of the Mysore Government, which, with commendable enterprise, financed the construction of a branch railway, 10 miles in length, running from the Bowringpet junction of the Bangalore-Madras line, which was opened for traffic in 1894; installed plant in 1901 for the provision of electric power generated at the Cauvery Falls—93 miles distant from the Gold Field; and later, in 1903, provided the mines with a filtered water supply from Bethamangala, a few miles away. In these and numerous other directions, including the privilege of sending a member of the Kolar Gold Field Mining Board to the Annual Assembly of Representatives, the Government has conferred benefits on the industry and the mining community which have been invaluable.

BRIEF ACCOUNT OF MINING AND REDUCTION METHODS ON THE KOLAR GOLD FIELD

To those who are unacquainted with deep mining methods, a brief description of operations such as are carried out on the Kolar Gold Field may be of interest.

The primary object of all metalliferous mining is to remove and separate the valuable minerals from the surrounding rock, though the method of excavation and reduction to the final product must necessarily vary greatly in different localities.

The gold bearing ore on the Kolar Field occurs in the form of a reef or vein of quartz, which out-crops to the surface and extends downwards to great depths. The direction of this reef—termed the strike—is approximately north and south, and it has a western dip which varies from about 40 degrees near the surface to almost vertical in the lower portions of the mines. The reef consists of quartz varying in thickness from a few inches to as much as 30 feet in rare instances. The average width of the quartz vein may be said to be approximately 3′ 6″ throughout the Field. The reef is bounded on the east and west by diorite schist, which forms the country rock of the district. This country rock and the reef are intersected by a number of dykes or tongues of dolerite, which vary in thickness from a few inches to over 100 feet.

The earliest operations of the Mining Companies consisted of exploring the reef in depth by sinking small shafts. At intervals from these shafts, levels or galleries were driven for the purpose of lateral exploration. These levels were connected together by small shafts, or "winzes," which were sunk from the levels and served the purpose of dividing up the ore body into workable blocks. The actual excavation of these blocks of ore, or stoping as it is called, consists of drilling holes in the quartz by hand labour and blasting them by some explosive.

The broken rock was passed down the winzes, where it was loaded into trams running on rails in the level

below, and conveyed to the shaft for hoisting to the surface.

After some years of profitable mining on the above scale, the persistence of the reef to greater depths called for more efficient methods of mining. As the original shafts sunk on the reef had become tortuous owing to the varying dip of the quartz, hoisting was costly and inefficient. Sinking of larger shafts was then undertaken, which were sited in such positions as to intersect the reef at a greater depth. These shafts were sunk to the west of the outcrop, and were either vertical or inclined.

As sinking was carried out in the homogeneous country rock, it was possible to maintain these shafts truly vertical, or on an uniform incline grade, which greatly increased speed of hoisting and facilitated repair work and maintenance. At intervals in these shafts stations were cut and cross-cuts—which are galleries driven at right angles to the strata—were put out to the ore body.

From these cross-cuts, the driving of levels for the development of the reef, and the subsequent excavation of the ore are carried out on similar lines to those mentioned above, but, with modern mining methods and the introduction of improved machinery, the efficiency has been greatly increased.

Owing to the continued western tendency of the reef, it has been found necessary within recent years to develop the ore body in depth by means of subsidiary shafts, sunk from convenient positions underground and fully equipped with electric hoists, etc.

As in the case of those from the surface, some of these subsidiary shafts are vertical, and others inclined. The vertical shafts are sunk from points some hundreds of feet to the west of the bottoms of the shafts from surface, and by stepping off the subsidiary shafts in this manner, the reef is again intersected at still greater depths. In the case of the inclined shafts the grade is determined by the dip of the reef, and, though they are not sunk on the reef, they are approximately parallel

to it, thus avoiding long cross-cuts, which are generally necessary in the connection of vertical shafts with the reef line.

Shafts are lined with strong timber frames, termed sets, which are placed a few feet apart, and in plan are rectangular. Planks are placed between the sets and serve to prevent any loose rock from the walls falling into the shafts.

The sets are supported at suitable intervals by "bearing pieces," which are strong timber beams let into the rock at either end of the shaft.

It has latterly been the practice to sink vertical circular brick-lined shafts, similar to those in use in the collieries in England. These shafts, of which there are five on the Kolar Field, are 18 feet in diameter, and have reached great depths; one such shaft, having attained a depth of over 4,200 feet, is not yet completed. Circular shafts, though expensive as to first cost, are very satisfactory, and require but little repair, as compared with rectangular timbered shafts. Their sectional area, admitting of the passage of a large volume of air, is very beneficial from the point of view of the adequate ventilation of the mines.

The sinking of shafts and the driving of levels, etc., is accomplished by the aid of rock drills operated by compressed air, and working at a pressure of from 60 to 90 lbs. per square inch. The rock drills are percussive, and holes are drilled in the rock varying in length from 2′ 6″ to 4 feet. By the correct placing of the holes for the reception of the blasting charge, levels and shafts have been advanced or sunk over 100 feet monthly. The compressed air is supplied by electrically driven machinery situated on the surface.

The adequate ventilation of the working places presents a difficult problem to the management, and only by the use of large electrically driven fans and the provision of suitable air-ways has this object been attained.

Some idea of the extent of the magnitude of the underground operations on the Kolar Field can be

gathered from the fact that up till the end of 1922 no less than 327 miles of levels have been driven and over 25 miles of shafts have been sunk on the various properties. The mines have also attained a great depth; two of the properties are now operating at a depth of over 6,200 feet vertically below the surface.

The surface treatment of the ore varies slightly on the different mines, but the essential methods of reduction are the same throughout the Kolar Field. The ore is raised to the surface through the shafts, waste rock is picked out, and the quartz is crushed to road-metal size by rock crushers of various types, and is then fed, together with water, into the stamp battery, which reduces it to sand. The stamp mill or battery consists of a large number of vertical hammers or stamps, which work in groups of five in steel mortar boxes. The stamps are raised by means of cams attached to a cam shaft, which is driven from a main shafting by belts and pulleys. The cams, as they revolve with the cam shaft, raise the stamps, which fall again by gravity when raised to a certain height. The stamps, which are 1,300 lbs. in weight, deliver 96 blows per minute from a height of 9½". The stamped product with water passes through metal screens placed in front of the mortar box, and flows over copper plates which have been amalgamated with mercury. The plates are 10' by 5', and are set at an inclination of 1 in 10 falling away from the battery. On these plates 70 per cent. of the gold contents of the ore is retained in the form of an amalgam of gold and mercury.

The crushed ore, after passing over the amalgamated plates, flows through a launder or drain to the classification plant, where the coarse sand is separated from the fine sand or slime. The method of separation is purely by gravity, the heavier particles falling to the base of inverted cones, while the fine product overflows the upper edge with the accompanying water. The coarser sand then passes to the tube mills for further grinding. Tube mills consist of large metal cylinders 22' by 5' 6", the major axis of which is set horizontally.

These cylinders make 27 revolutions per minute, and contain pebbles of hard quartz which assist in the grinding of the coarse sand fed in at the centre of one end. The discharge from the tube mills is reduced to practically the same size as the overflow from the classification plant mentioned above. The product from the tube mill passes over another set of amalgamated plates, where a further 15 to 18 per cent. of the original gold content of the ore is extracted. The next stage in the extraction of the remaining gold from the finely crushed ore or slime is by what is known as the cyanide process. This process is based on the ability of weak solutions of potassium or sodium cyanide to dissolve gold, which can again be collected by precipitation. The slime is agitated together with the cyanide solution for a considerable time, after which the gold is practically all in solution. The separation of the gold-bearing cyanide solution from the finely ground ore is accomplished by filtration. The filters in general consist of a number of hollow frames or leaves, 10′ by 5′, by a few inches thick, covered with canvas. These leaves are lowered into the slime from which the gold bearing cyanide solution is to be separated, and by means of vacuum pumps acting on the inside of the leaves the gold-bearing solutions are drawn through the canvas, while the slime adheres to the outside of the canvas in the form of a cake 1½" thick. This cake of barren slime is in turn removed, after washing, by the admission of water to the inside of the leaf causing the slime to fall off into a receptacle placed beneath.

The gold-bearing solutions are then passed slowly through boxes containing zinc shavings, and the gold is precipitated on the zinc in the form of black mud. This mud is periodically removed from the boxes, dried in furnaces along with nitre to oxidise any small pieces of zinc that may be with it. After drying, the precipitate is fluxed with sand, manganese dioxide, borax and soda, and smelted in graphite pots placed in an oil-fired furnance. The bullion obtained contains 800 to 900

parts of fine gold per 1,000, together with 70 to 100 parts per 1,000 of fine silver, and 10 to 100 parts of base metal. The gold-mercury amalgam obtained from the mill and tube mill plates is collected and retorted in a furnace, which separates out the gold from the amalgam by the volatilisation of the mercury. The mercury vapour is condensed in a water-cooled receptacle, and returned to the mill for further use. The gold remains in the retorting furnace in the form of sponge gold, which is re-melted and cast into bars, which contain from 900 to 940 parts of gold per 1,000, 50 to 90 parts of silver, 10 parts of base metal. The losses in gold in reduction are very small, the total extraction being over 98 per cent. of the gold contents of the ore.

MYSORE CITY

MYSORE is the capital of the State and residence of the Maharaja ; it is situated 86 miles to the south-west of Bangalore, at the north-western base of the Chamundi Hill.

" The city is built in a valley formed of two ridges, running north and south. There is also a slight ascent on the northern side. The streets out of the Fort were comparatively broad and regular, and contained many substantial houses, some of them two or three storeys high. Within the Fort, which is in the southern quarter, the streets were narrow and irregular, and most of the former houses had a mean and squalid appearance. But the great extension of the city, especially to the south-west, during recent years, and the immense improvements introduced on all sides, have so completely transformed the place that persons who knew Mysore as it was thirty years ago, would hardly recognise the present handsome and growing city, with its magnificent wide roads and imposing buildings."

Conspicuous on the high ground, in Gordon Park, are the Public Offices, surmounted by a dome with the statue of Sir James Gordon in front of the buildings. Close by are the Victoria Jubilee Institute and the pile of the Mysore University buildings. Farther west are the groups of the Law Courts.

In the older parts of the city, the changes have been equally strilking. The most important, perhaps, has been the filling of the great drain known as Purnaiya's *Nullah*. Its place has been taken by a fine wide road, called the Sayaji Rao Road, named after the Gaekwar of Baroda. The Sri Narasimharaja Boulevard, on the way to Chamundi Hill, and the Nishat Bagh, close to Hardinge Circle, are similar improvements.

THE PALACE, MYSORE CITY

The race course with the polo ground, which it encircles, is another spot of great attraction in Mysore City. With lakes on either side, beautiful buildings in the distance on one side ; and lovely gardens, thick wood in front and the stately Chamundi Hill beyond, the situation of the race course is picturesque in the extreme.

The Palace. The structure measures 245 feet by 156 feet, and is 145 feet high from the ground level to the topmost point of the final of the main dome. In the centre of its front or eastern face is a carriage porch, measuring 66 feet by 21 feet. From this porch there is a passage 15 feet wide, flanked on both sides by the *Sajje*, or piazza, and leading at its western end through the corridors to the marriage pavilion on the south and to the residential apartments on the north. The passage opens into an inner courtyard or quadrangle. At each end of the *Sajje* there is a staircase leading to the first and second floors. The open courtyard, the corridors running all round its sides, and the marriage pavilion, take up most of the ground floor. The southern block consists of ambavilas (ground and first floors). On the ground floor of the north block are the armoury, the library, the annexe with the electrical lift room, and the servants' staircase. The drawing and the music rooms are on the first floor, while the second floor is occupied by bedrooms. On the first floor in front, immediately over the *Sajje*, is the durbar hall, which measures 155 by 42 feet, while study rooms are formed on the second floor. The third, fourth and fifth, formed only on the centre block, do not contain any principal apartments, but form the supports for the main cupola.

The general appearance and the outline are Indo-Saracenic, but the details of decoration of panels, friezes, nitches, etc., are distinctly Hoysala. The central dome is the dominating feature, while the rest are all subordinate to it. The mode in which the principal face is broken up and varied by cupolas, minarets, balconies, verandahs and porches, so as to secure light and shade, is marvellous in effect. The

porch in front, with high pillars, and the richly-carved stone cantilever verandahs, are a feature in themselves. From the basement to the base of the main dome, the surface is adorned with rich sculptures of the very best class of Indian art. Horizontal mouldings, vertical off-sets breaking up the surface into many projections, recesses, niches and panels relieved with superabundance of deep, sharp and fine carvings of scrolls, foliage, birds, animals and statuettes of very chaste and elegant design, are the chief characteristics of this Hoysala style of decoration. It is the combination of this fine sculptured style with the lofty grandeur and magnificent proportions of Saracenic art that gives to the structure a very pleasing appearance and produces striking effects of light and shade.

The carvings in stone, wood and ivory, stone inlaying, stucco work and paintings are rich in pattern and varied in design. The stone carver has shown his patient labour in elaborating the details of his fancy; the wood carver, the facility with which he could turn his chisel to work out beautiful carvings in wood; the decorator and painter, as to how far his brush can excel other decorations.

Many varieties of granite, porphyry, gneiss and trap have been used in the various parts of the structure The porphyries have variegated spots of appropriate tints, which lend a cool and charming effect to their polished surface. The trap and the potstone have been largely used in the sculptures and the enrichment of panels, recesses, etc. The former is of greenish-blue colour and the latter light-grey. The colour combination, as a whole, with the highly artistic and very elaborately wrought work, adds to the marvellous grandeur of the edifice.

The principal institutions in Mysore City are the Sri Krishnarajendra Hospital, the Vani Vilas Hospital for Women and Children, the University of Mysore, the Chamarajendra Technical Institute, and the Institute for the Deaf-Mutes and the Blind.

Sri Krishnarajendra Hospital. This hospital, which was

originally known as "General Hospital," was started in 1876, and its name was changed to Sri Krishnarajendra Hospital in April, 1918, when a new building was constructed at a cost of over 4 lakhs of rupees. The main building is two storeyed, terraced and fitted with up-to-date sanitary fittings.

School for Deaf-Mutes and the Blind. This institution was founded in 1901, and is managed by a local committee with substantial aid from Government.

Mysore is the headquarters of the Indian Association of Workers for the Blind, which was started in 1917.

SERINGAPATAM

PROPERLY Sri-Ranga-pattana, is situated at the western or upper end of an island in the Kaveri, about three miles in length from west to east, and one mile in breadth. The eastern end of the island is occupied by the prosperous suburb of Ganjam.

In the earliest ages, Gautama Rishi is related to have worshipped Ranganathaswami, whose temple is the principal Hindu building in the Fort, and to have done penance in this, the western or Paschima Ranganatha Kshetra, as distinguished from the eastern or Purva Ranganatha Kshetra at Srirangam near Trichinopoly.

In 894, during the reign of the Ganga sovereigns, a person named Tirumalaiya appears to have founded on the island, then entirely over-run with jungle, two temples, one of Ranganathaswami and a smaller one of Tirumala Deva, enclosing them with a wall, and to have called the place Sri-Ranga-pura or pattana. Subsequently, about 1117, Ramanujacharya, the celebrated apostle of the Sri Vaishnavite sect, on fleeing from the Tamil country to avoid a confession of faith prescribed by the Chola Raja to be made by all his subjects, the object of which was to establish the superiority of Siva over Vishnu, took refuge in the Mysore country, where he succeeded in converting from the Jain faith the powerful royal convert, who conferred on his apostle and his followers the tract of country on each side of the river Kaveri at Seringapatam, known by the name of Ashtagrama, or eight townships, over which he appointed his own officers under the ancient designations of Prabhus and Hebbars.

In 1454, Timmanna, a Hebbar, descended from one of these, lord of Nagamangala, obtained, by a visit to

SERINGAPATAM 1799

Vijayanagar, the government of the district with the title of Danayak, and permission to erect a fort at Srirangapattana. This he did with the aid of a hidden treasure he had discovered, and enlarged the temple of Ranganathaswami, making use of the materials obtained from the demolition of 101 Jain temples at Kalasvade, midway between Mysore and Seringapatam. His descendants held the government until 1496, when Seringapatam passed into the direct possession of the Vijayanagar kings. For, we learn from inscriptions that Narasa, the founder at that time of the second Vijayanagar dynasty, "quickly damming up the Kaveri when in full flood, crossed over and captured the enemy (unnamed) alive in battle. Taking possession of their kingdom, he made the ancient Srirangapattana his own." It was eventually administered in the name of the Vijayanagar sovereigns by a viceroy known as the Sri Ranga Rayalu. Tirumala Raja, the last of these Rayalus, was a relative of the royal family.

In 1610, Tirumala Raja, worn out with age and disease, surrendered his power to Raja Odeyar, the rising ruler of Mysore. Thenceforth Seringapatam became the capital of the Rajas of Mysore, and continued to be the seat of government under the Musalman dynasty until its capture by the British in 1779.

By this victory Seringapatam became the property of the British Government, who leased the island to Mysore for a fixed sum of Rs. 50,000 a year. Seringapatam began rapidly to decline after the close of the war, and its decay was proportionate with the rise of Mysore. Fever also gradually made its appearance and necessitated the removal of the troops to Bangalore, where the new cantonment was formed in 1809.

At the south-west angle of the Fort may be viewed the breach made in 1799, the spot from which the storming party issued on the opposite side of the river being marked by a memorial erected by His Highness the Maharaja to celebrate the centenary of this great event. Within the walls, surrounded by a high enclosure, are the remains of the Musalman Palace, now converted

into a sandalwood store, but the greater part was demolished. Near the large temple of Sri Ranganathaswami, which is close by, a memorial has been built to mark the site where stood the ancient palace of the Rayalus or viceroys of Seringapatam and of the Rajas of Mysore. A large mosque, erected by Tippu, with two tall minarets which are conspicuous from a great distance, is in front of the Mysore Gate. The spot where Tippu fell is on the north face.

Daria Daulat Bagh. Just outside the Fort, on the island, is the Daria Daulat Bagh, or "Garden of the Wealth of the Sea," a summer palace which was Tippu's favourite retreat from business. Its graceful proportions, and the arabesque work in rich colours with which it is covered, render it very attractive. Part of the walls is adorned with pictures in a style of broad caricature, representing Colonel Baillie's defeat at Conjeevaram in 1780, Haidar and Tippu as they appeared in public processions, and numerous figures of Rajas and Palegars. These representations had been defaced by Tippu prior to the siege, but after the capture of Seringapatam were restored by Colonel Wellesley, who occupied the palace for some time. They were again allowed to become partially obliterated, until Lord Dalhousie, during his tour in Mysore, caused them to be re-painted by a native artist who remembered them as they were. The perspective is very bad, and the general effect is grotesque, but the artist has succeeded well in caricaturing the expression and attitude of the British soldier, and the Frenchmen under Lally must have been taken from life.

Lal Bagh. At the eastern end of the island towards the south is the Gumbaz, or mausoleum, which was built by Tippu for his father, and in which he also is buried, as well as his mother. It is a square building surmounted by a dome with minarets at the angles, and surrounded by a corridor which is supported by pillars of black hornblende. The interior is painted in lacquer with tiger stripe, adopted by Tippu for military uniforms. The

louble doors, inlaid with ivory, were renewed by Lord Dalhousie. Each of the tombs is covered with a handsome pall. The mausoleum is supported at Government expense. A tablet on the tomb of Tippu contains some verses, in which the following expressions—The light of Islam and the faith left this world; Tippu became a martyr for the faith of Mahomed; the sword was lost; the offspring of Haidar was a great martyr—by a process called *Abjad* give 1213 as the date of his death according to the Muhammadan era of the Hezira. A short distance from the entrance to the Gumbaz is the tomb of Colonel Baillie, erected in 1816 by his nephew, Resident at the court of Lucknow. Of Tippu's palace, which stood in the Lal Bagh, nothing now remains. Buchanan in 1800 says of it, "Though built of mud, it possesses a considerable degree of elegance, and is the handsomest native building that I have ever seen."

On the rising ground called Sabbirani Tittu, to the south of Daulat Bagh, is a small monument to officers who fell in the final siege.

KRISHNARAJASAGARA

FOR many years past, the Government of Mysore had under consideration a project for a reservoir across the Cauvery river, for extending irrigation in the State. In 1902 the falls at Sivasamudram were harnessed to generate electric power for use in the gold mines of Kolar and in the cities of Mysore and Bangalore. The river brings in a flood of about 250,000 cusecs in the monsoons, but the flow in summer sometimes dwindles to less than 100 cusecs. The output of power, being necessarily governed by the least dependable supply, could not be increased nor even protected unless the natural flow was supplemented by storage.

Objects of the Reservoir. The construction of the reservoir now in progress, at a site 12 miles to the north-west of Mysore, was accordingly undertaken in 1911 with the three-fold object of—

(i) Keeping up an adequate supply of water for hot weather crops ;

(ii) Ensuring a constant supply of water for the already existing electric power installation at Sivasamudram and also to increase the output of power by new installations ; and

(iii) Increasing the irrigation in the valley.

What is Proposed.—The project provides for—

(i) A masonry dam, 124 feet high above the river bed and 6,550 feet long, a reservoir of 41,500 million cu. ft. capacity with 1,700 feet length of waste weir ;

(ii) A canal system to irrigate 125,000 acres of land in the adjacent taluks ;

(iii) Extensions and improvements to the power installation at Sivasamudram, by which the output will be increased ultimately from 13,500 to 32,500 h.p.

Excluding the power installation, the scheme is esti-

ИЗОГИЗ

ОТКРЫТОЕ ПИСЬМО

Куда _____

_____

_____

Кому _____

_____

Обр адрес _____

_____

И. Н. Крамской (1852–1887)
Мордвиновские дубы. 1881 г.
Государственный Русский музей

Редактор Н. Лембо Изд. № 774. 1955 г.
М-42151. Подписано к печати 26/VII-55 г.
Тираж 200 000. Цена 25 к. Зак. 893.
Ленинград. 4-я тип. им. Ивана Федорова

KRISHNARAJASAGARA DAM

mated to cost Rs. 480 lakhs at its final stage. In the last ten years, the masonry of the dam has been brought up to 107 feet above bed on both the banks.

A temporary weir gap of a length of 900 feet is left in the river portion of the dam, with its crest at 80 feet above bed. Foundations for the permanent weir have been partly laid.

A set of eight deep-level sluices have been built to pass the required supplies for existing irrigation in Mysore and Madras, while three other sluices have been provided on the north bank for the high level canal proposed to be opened. It is also under contemplation to guarantee 3,000 h.p. immediately below the dam, for which four turbine sluices have been erected.

Two new canals, one on either bank, have been opened from the reservoir 40 feet above bed, to irrigate 5,000 acres of land, chiefly to settle the population whose lands were submerged by the reservoir.

The storage already effected has enabled increasing the output of power to 22,500 h.p.

The outlay so far has been Rs. 170 lakhs on works of the dam and canals, and Rs. 30 lakhs on the additional power works.

The work remaining to be done is raising the dam to 124 feet above bed, and completing the waste weir. A length of 1,200 ft. of the latter has to be provided with gates on crest. Some of them are intended to be made automatic in action, so that when water rises above full reservoir level they may open, and close as the water falls, while others will be regulated by electric power. Twenty sluice gates, 10′ x 20′, with sill at 80 feet above bed, will also be provided adjacent to the weir for surplusing at times of maximum floods.

The high level canal proposed, which is estimated to cost Rs. 245 lakhs, is yet to be taken up.

The reservoir now under construction when completed will be the largest artificial lake in India, and second to the Assuan Dam in Egypt, which is the biggest in the world.

PLACES AND OBJECTS OF INTEREST

BANGALORE itself possesses few features of interest which, in one form or another, may not be met with in the larger cities in other parts of India. Industrially it is less advanced than the great Presidency towns; and generally speaking its provision for the material needs and the mental culture of the population, duly proportioned to its size, has necessarily been developed on a smaller scale. To students of anthropology, archæology, and the natural sciences, subjects in which the interest is independent of size and wealth, the city and the province of which it is chief in respect of area and population, present a field of study comparable in extent and variety with that to be found in most other parts of the country. Reference has already been made to these matters in some of the foregoing articles. At the same time, notwithstanding its remoteness from coal-fields and its landlocked situation, the province of Mysore possesses four examples of modern scientific and industrial enterprise that are in some respects unique in India—*viz.* the gold mining industry near Kolar, the great dam at Kannambadi, the Indian Institute of Science, and the Sandalwood Oil Factory.

The following short list[1] of objects and places likely to interest visitors is very far from being exhaustive, and there are many others which, for those with sufficient time at their disposal, are well worth a visit. The road map which accompanies this volume will probably enable visitors to find their way about Bangalore without undue difficulty.

[1] Places which are comparatively inaccessible or require more than a full day for the return journey have been omitted.

Arts and Crafts. The Mysore Arts and Crafts sale room is in St. Mark's Road, nearly opposite St Mark's Church. Interesting examples of local work in brass, lacquer ware, ivory, sandalwood and other materials may be seen and purchased here, as well as curios and articles from outside the State. Toilet and other soaps manufactured in the Government Soap Factory are also on sale.

Banks. The three principal banks are the Imperial Bank of India (Bangalore Branch), situated in St Mark's Road ; the Bank of Mysore, in Avenue Road (close to the Central College); and the Bangalore Bank, in South Parade. The hours of business are from 11 a.m. (10.30 in the case of the Bank of Mysore) to 3 p.m. on week days, excepting Saturdays, when they close at 2 p.m.

Clubs. *The United Service Club* is in Residency Road. It is the chief meeting place for the European residents of Bangalore, and has extensive grounds, tennis and racquets courts, and a small library. Regimental bands play on two or three evenings a week.

The Century Club was established a few years ago, largely with the object of providing opportunity for Indians and Europeans to meet on social ground. It is located in the Cubbon Park, and has several good tennis courts and an excellent golf course.

The Ladies' Club is in Avenue Road, and extends its membership both to Indian and European ladies.

The Bangalore Gymkhana Club, situated at the east end of the maidan adjoining South Parade, affords facilities for cricket, polo, hockey, rugger, and tennis.

The Bangalore Golf Club, established in 1876, is at the top of Avenue Road. The 12-hole course is laid out on the open land adjoining the Bellary Road.

Cubbon Park. This park, originally laid out by Major-General Sir Richard Sankey, was named after Sir Mark Cubbon, late Chief Commissioner of Mysore, and has an area of more than 100 acres. Prominent objects in

the park are the Public Offices, built in 1864-1868 at a cost of Rs. 14 lakhs, where many of the principal offices of the Mysore Government are located; the Victoria Memorial Statue (unveiled in 1906 by H.R.H. the Prince of Wales) at the east entrance; and the King Edward VII Statue at the Cubbon Road entrance, near the telegraph office.

Extensions. The four most important suburbs of Bangalore City are the extensions known as Chamarajapet, Shankarpur, Basavangudi, and Malleswaram, of which the first named is the oldest. These extensions are laid out on the "gridiron" plan. They are rectangular, with the boundary roads running north and south, and east and west. At the southern end of Basavangudi is the Bull Temple, which is a favourite resort for picnic parties. The Bugle Rock, in front of it, affords a panoramic view of the whole city from its railed platform.

Experimental Farm, Hebbal. The farm is situated five miles from Bangalore on the Bangalore-Chikkaballapur road, and comprises about 60 acres of dry land and about 20 acres of wet land, which latter is situated below the Hebbal tank, which supplies water all the year round save in exceptional years.

The farm came into being in 1905, and it was then organised by the Agricultural Chemist to the Mysore Government. From that time until the year 1912, when the Agricultural Department was reorganised, the scope of the work on the farm was quite limited. With the reorganisation of the department, the activities of the farm increased, and there was a rearrangement of the experiments conducted on it.

The principal crops on which experiments are being conducted are ragi, paddy, and sugarcane.

The object of the present "Plant breeding" work at Hebbal is to provide the Mysore ryot with good seed and to evolve for him better strains than he has at present. For this purpose two of the most important

crops have been selected for improvement, *viz.* ragi and sugarcane. Work on these two crops was started in 1913 and some useful results have been already obtained.

Ragi. Experiments have been in progress with regard to (1) the advantages of sowing ragi as a pure crop, as compared with mixtures of avare and jola. (2) Rotation experiments with avare, ground nut, and togari. (3) Response of ragi to some green manures compared with its behaviour towards other common manures. (4) Selection of ragi by salt water method and sieving ; and (5) relative spacing tests and different methods of sowing.

In addition to these experiments, trials are made with different varieties of ragi—both those that are bred on the farm and those that are obtained locally. The variety known as H_{22} has so far given the best results, and this variety is being distributed on a fairly extensive scale.

Paddy. (i) The importance of determining with some degree of accuracy the extent of land that can be put under paddy, with reference to the amount of water available for irrigation, has been realised, and experiments are being conducted to arrive at some data for this purpose. Technically these investigations are known as "Duty of water" experiments. For this purpose, a series of $\frac{1}{10}$th acre plots are taken, and, after paddy seedlings are transplanted, measured quantities of water are given to these plots at different intervals, allowance being made for water received by the plots in the form of rain.

(ii) The effect of various manures are being tried on paddy. The indications so far all point to the superiority of green manures over farmyard manure. There is not much to choose between the green manures themselves; but sann hemp seems to do slightly better than hongey leaves.

(iii) It is believed that ordinarily too much seed is sown, with the result that the seedlings that are planted are not very vigorous and they are also planted rather

close. Therefore a series of plots have been laid out to find out if the seed rate cannot be reduced. The seed rate that is generally adopted locally is taken as the standard, and this is compared with fractions of this quantity. It is found that the smaller seed rates give more robust seedlings, and the crop also seems to be decidedly better. Thus there is a considerable saving of seed combined with an increased yield by using a smaller quantity of seed per acre.

Sugarcane. This being a crop that responds readily to the application of concentrated manures, and the supply of oil cake, especially of hongey (*Pongamia glabra*) and castor (*Ricinis communis*), being fairly plentiful in the State, experiments were undertaken to find out the effect of applying these cakes to sugarcane in varying quantities. For this purpose a series of narrow strips were laid out, every third strip being given cattle manure at 30,000 lbs. per acre, and these were taken as the check strips for comparison. The plots between the check strips were treated with castor and hongey cake respectively, in two-ton and three-ton doses, the whole series being repeated three times. Results so far obtained show that superior yields are obtained from the strips receiving the two ton doses, castor giving better results than hongey.

Definite experiments to find out requirements of nitrogen and phosphorus have been started, using ammonium sulphate, cyanamide and super. In addition, work is being done to determine the optimum amount of space between sugarcane rows, rotating with turmeric, and trials of different varieties obtained by selection as well as from seedlings.

Besides the crops and the experiments on them as detailed above, there are other features which will interest a visitor to the farm.

One is the Veterinary Dispensary recently opened in connection with the Agricultural School. Here are treated animals from the neighbouring villages.

There is a hostel and lecture rooms in connection with the Agricultural School. There are also various

implements which are kept for practice by the students and for trials. As a result of work in this line the Mysore plough has been evolved, and is being distributed to the cultivators.

Farther on come the dairy buildings, consisting of rooms for separating and butter making, the stalls for the dairy cattle, feed rooms, calf pens, etc. Practical instruction in dairying is given to the students of the Agricultural School, and some butter is also sent out to up-country stations. The herd consists of both buffaloes and cows.

Improvement of the quality of wool in sheep has been taken up, and Merino rams have been imported for this purpose. There are now a number of selected Mysore ewes and half breeds as a result of the crossing.

Fort. This is reached by way of Avenue Road and Doddapete, and has been already described in the article on History and Archæology.

Indian Institute of Science. Situated three miles out of Bangalore on the Tumkur Road. This institution has been fully described in a separate article.

Jail. The Central Jail is located opposite the Central College, in one of the angles formed by the Sheshadri and Avenue Roads. It is the place of incarceration of all life and long-term prisoners in the province of Mysore. Extensive, well regulated, strictly supervised, and possessing a large industry of its own, this institution may well be considered a model one. All long-term inmates are taught to practise some trade or to do some work, and are thus furnished with a useful occupation during their imprisonment, and with the means of earning a livelihood on regaining their liberty. Instruction in reading and writing is also given to all juveniles who can benefit by it. Among the articles manufactured in the jail are jhools, pile carpets, cumblies, cloths of every description, towels, money-bags, horse rollers, ropes, coir matting and rugs, carpenters' and smiths'

work, baskets and cane-work, the articles turned out being good and serviceable.

Jewell Filters. There are three of these, situated on the left of the Tumkur Road a little beyond Sankey's Tank. They are 17 feet in diameter, and capable of filtering 386 gallons per minute each. From them the water is distributed in iron mains to the City.

Lal Bagh. The Lal Bagh is the name of the Government Botanical Gardens in Bangalore, and covers an area of 100 acres. From the entrance gates a long drive runs round the gardens. The flower beds are beautifully arranged, and the various species of trees make a splendid show. A spacious glass house has been erected, and in this a flower show is held in February and August. In the flower garden near the Band Promenade, a very fine equestrian statue of His Highness the late Maharaja Chamaraja Odeyar, G.C.S.I., has been erected. The Fernery, containing a good collection of ferns and foliage plants, is well worth a visit. The garden is open every day from 7 a.m. to dusk. The garden office and seed depot is open for business from 11 a.m. to 5 p.m. daily (Sundays excepted).

Libraries. *The Public Library* is located in the Sir Sheshadri Iyer Memorial Hall, Cubbon Park, and is open throughout the year, except on Mondays. It contains a reading room with a large selection of newspapers and periodicals, as well as a reference and lending section. Books are lent only to members.

The Bangalore Library, in South Parade, was established in 1813 as the "United Service Library," and was the first Garrison Club and Library to be organised in the district. It is now used by the members for social as well as literary purposes.

Medical Institutions. Beside the military hospitals, the following are the most important medical institutions in Bangalore. Of those mentioned the Bowring and

Lady Curzon Civil Hospitals are in the C. and M. Station, and the others are in the City, and are maintained by the Government of Mysore.

Bowring and Lady Curzon Civil Hospitals. The Bowring Hospital was the only civil medical institution in the Civil and Military Station of Bangalore till 1900. It provided accommodation for 80 male and 24 female patients.

Recognising that 24 beds for females were quite inadequate for a Station which, even then, was growing rapidly, six Indian gentlemen provided funds towards the erection of a series of buildings, which would provide more extensive accommodation for female patients. These gentlemen were Rao Bahadur Arcot Narayanaswamy Mudaliar, Rao Bahadur Maigandadeva Mudaliar, Rao Bahadur B. P. Annaswamy Mudaliar, C.I.E., Mr. V. Gangadhara Chetty, Khan Bahadur Hajee Sir Ismail Sait, and Dr. B. N. Darabseth, of whom it is much to be regretted that four have died, the two left being Rao Bahadur Annaswamy Mudaliar and Khan Bahadur Hajee Sir Ismail Sait.

These generous donations, helped by a grant of funds from Government for the erection of a large European and non-caste Indian block, and for isolation maternity wards, provided 123 beds for women and children of all castes and creeds, including 28 beds for normal maternity cases and 16 beds for maternity cases needing isolation.

The new female wards were formally opened on December 10th, 1900, by Her Excellency Lady Curzon, who graciously allowed the group of buildings to be called "The Lady Curzon Hospital for Women and Children."

The new buildings, though forming an integral part of the Civil Hospital of Bangalore, were separated, at first, from the main building by a noisy thoroughfare, which was the direct road to the Market. The disadvantages of such an arrangement, both as regards noise and dust in the wards and difficulty in administra-

tion, were obvious, so, in the year 1913, after urgent representations to the Municipal Commission, the road was closed, and the male and female wards brought into the same compound. The entrance gate, presented by Mr. Ahmed Sait, was formally opened by Her Excellency Lady Hardinge on November 19th, 1913, and opens into the common hospital garden. The male and female sides of the hospital have been connected by a covered way, and the institution works as one, under the title of the "Bowring and Lady Curzon Civil Hospitals."

Both male and female hospitals, in early days, were extremely poorly equipped, for proper instruments and hospital furniture, laundry, operation rooms, facilities for sterilization and aseptic treatment, electric light, X-rays, quarters for the staff and nurses and proper arrangements for bathing and sanitation, all were lacking, while the brick floors and whitewashed walls were far from ideal in a hospital where efficient surgery would be expected. The medical and nursing staff, too, was far too small to deal efficiently with over 200 beds. By private generosity, and by grant of funds from Government amounting in all to about Rs. 6,00,000, the essentials have been supplied, and Bangalore has now an excellently equipped and well-staffed Civil Hospital.

Medical, Surgical and Maternity Work. The aim has been to work the Civil Hospitals of Bangalore on the lines of similar institutions in England, and to admit to the wards only those cases requiring surgical operations, or who, on account of acute disease, require skilled medical treatment and nursing. The result has been that the hospitals have now a staff and equipment capable of undertaking surgical and medical work of every class, and it should be stated that during the war these Civil Hospitals took over from the Military Department the entire treatment of all officers' wives and children and the families of non-commissioned officers and the garrison, thus relieving military medical officers for other duties. Increase of work has been

especially notable in the Maternity Department, and the scope of the work of the hospitals during the past ten years is show in the following table :

Year	In-patients	Out-patients	Operations	Maternity Cases
1914-15	2,765	31,087	2,569	562
1915-16	2,870	35,461	2,871	602
1916-17	3,045	35,398	2,457	602
1917-18	3,618	41,083	2,668	695
1918-19	4,137	40,701	1,770[1]	730
1919-20	4,489	41,491	2,747	..
1920-21	4,428	41,257	2,278	1,048
1921-22	4,426	41,248	2,404	..
1922-23	4,163	40,696	2,590	1,055
1923-24	2,684	21,101	988	632[2]

Nursing Department. In no part of the hospital work has improvement been more marked than in nursing. The nurses in 1900 numbered five, who were expected to look after 201 beds, while at present the number of beds is practically the same, but the nursing staff numbers 36.

The appointment to the staff of a nursing superintendent and three sisters, all with English qualifications, has introduced a higher standard, and has made it possible to carry out the training of pupils in general, gynæcological and maternity nursing.

A three years' course in general and gynæcological nursing is given, and a 12 months' course in maternity work. Lectures are given by the Residency Surgeon, the Senior House Surgeon and the sisters, and the hospital, so far as midwifery teaching is concerned, is affiliated with the Central Midwives Board in England.

The establishment of an efficient nursing service in these hospitals made it possible for the Civil Hospitals to undertake the care of military families as mentioned above, and great credit is due to the sisters

[1] Surgical work at a standstill for nearly three months, owing to influenza epidemic.

[2] From 1st April, 1923 to 31st October, 1923.

and nurses who willingly and successfully undertook this extra war work.

The nursing superintendent and sisters also voluntarily undertook lectures in home nursing, and the ward training of V.A.D. nurses, under the direction of the local centre of the St. John Ambulance Association in India. Of these a large proportion successfully passed their examinations, and many went as V.A.D. nurses to military hospitals. Many also were of great assistance during the influenza epidemic in September, October and November, 1918.

New Nursing School. As suggested above, the most important work of the nursing superintendent and sisters, is the training of pupils, both in the lecture room and in the wards. In 1917 a large addition to the nurses' quarters was built, with reading room and lecture theatre, and the quarters can now accommodate 23 pupils in addition to the four sisters and eight charge nurses of the staff. A certain number of paying pupils are also taken, and certificates of training in medical, surgical and gynæcological nursing, and in midwifery are given to those successful in their examinations. Though the school is only in its infancy, 31 pupils have received certificates in general nursing and 39 in midwifery. Several of our nurses have been appointed to be charge nurses at other civil hospitals, and two have been promoted to be matron, so that it may safely be stated that the new school is doing good and useful work. By permission of Her Excellency Lady Chelmsford, the nursing school is now called the Lady Chelmsford School of Nursing.

Private Wards. The problem of how to deal with the old female wards and certain accommodation in the Lady Curzon Hospital has been solved by turning them into private wards for the treatment of better class patients. Daily fees are charged, and the income to Government derived therefrom has gradually increased year by year.

Kitchen. The cooking for all patients and the nursing staff is carried out now in a large central

kitchen, and is done entirely by electricity. This is found to be clean, easy to work and efficient, and is also inexpensive, owing to the cheap rate at which electrical power can be supplied by the Cauvery Electric Power Works.

Victoria Hospital. This institution was opened by Lord Curzon on the 8th December, 1900, and is centrally situated on a site midway between the city and its extensions. Prior to 1881, the chief medical institutions in Bangalore were the Bowring Hospital, the Maternity, and the Pettah Dispensary. After the Rendition, the Bowring Hospital, being situated within the limits of the Civil and Military Station, became severed from the Mysore Government. In course of time it was felt that a suitable hospital, with accommodation for in- and out-patients was urgently needed. In 1893, owing to the increasing demand for medical aid, a suitable site for a new hospital, which would be worthy of the chief city of the State and situated in a spot within easy reach of the populous parts of the City was, after careful consideration, selected; and on this site the foundation stone of the new Victoria Hospital was laid by Her Highness the Maharani Vani Vilas Sannidhana, C.I., on the 22nd June, 1897, on the occasion of the Diamond Jubilee of Her Most Gracious Majesty the late Queen Victoria. The building, which is a most handsome and imposing architectural structure, cost seven lakhs of rupees.

It has accommodation for 176 patients, besides quarters for the hospital staff. Special wards for paying patients (both European and Indian) are provided. Departments for treating throat, nose and ear diseases, and dental ailments, and for X-ray work, have also been provided.

With a munificent gift of Rs. 25,000, given by Rajasabhabhushana Dewan Bahadur K. P. Puttanna Chetty, C.I.E., supplemented by Government grants, a new out-patient department has been constructed, and will be opened shortly.

By desire of H.H. the Maharani, C.I., the hospital is maintained as a public charitable institution, available free to all classes of poor sufferers without distinction, and it has become so popular that patients from outside the Mysore State seek admission. It is fitted with the latest implements and appliances, and it is claimed that those who resort to it derive all the benefits which modern science can provide for the alleviation of human suffering. It may deservedly be ranked as one of the finest hospitals in South India, and a fitting memorial to a sovereign whose reign was noted for great acts of public benevolence.

During the year 1922, 48,992 out-patients were treated, 3,637 in-patients were admitted, and 5,638 surgical operations were performed.

A Medical School for Training Sub-Assistant Surgeons was opened in July, 1917, and is attached to this hospital.

Minto Ophthalmic Hospital. Was opened in the early part of 1913, and is situated in Hardinge Road, behind the Victoria Hospital. Prior to it the Eye Hospital was located in a building on the Lal Bagh Road. As the accommodation was very limited, to meet the increasing demands for relief, the foundation stone of the above hospital was laid by His Highness the Maharaja of Mysore in December, 1910. It has accommodation for 64 men patients and 40 women patients. Out of the subscriptions realised from the "Poor Fund" of the hospital, glasses are given free of cost to poor students and poor patients after cataract operations, and trainage and medicine to poor indigent patients.

The Maternity Hospital is situated in the Cenotaph Road, and is a hospital chiefly for lying-in women. There is an out-patient department attached to it. Ante-natal clinics and baby clinics are arranged for every week, and during the last year 645 women and 470 babies were examined and treated.

The Vaccine Institute is located in the old Eye Infirmary. Vaccine lymph is prepared in the institute to meet the demands from all the moffusil stations of the State.

The Leper Asylum is located on the Magadi Road, and Lepers of the Civil and Military Station as well are admitted into the asylum for treatment, as there is no separate asylum in the Civil and Military Station.

Military Dairy Farm. This farm is now under the control of the Superintendent, Imperial Institute of Animal Husbandry and Dairying, and is situated on the left of the Oossoor (Hosur) Road, about half a mile beyond the Cemetery. There are a large number of very fine cattle, and the most up-to-date refrigerating and other machinery for the manufacture of dairy products has been installed. These products are of an exceptionally high quality, and the Farm is well worth a visit.

Museum. The Government Museum is in the Cubbon Park, adjoining Sydney Road. It was established in 1865, and the present building was opened to the public in 1877. The Museum is open free throughout the week, with the exception of Wednesdays and general holidays. The entrance hall contains exhibits of archæological and historical interest. Specimens of Indian jewellery, cloth, musical instruments, metal ware, lacquer ware, sandalwood carvings, inlaid work, ivory, pottery, agricultural and economic products, geological and carpological exhibits are arranged in the central hall. The gallery is mainly occupied by zoological material. There is a good collection of Mysore coins. There is also a small library containing books of reference attached to the Museum.

Mythic Society. This society has its offices and library, and holds its meetings, in the Daly Memorial Hall, in Cenotaph Road. Its objects are to promote the

study of the sciences of ethnology, archæology, history, religions and allied subjects, more particularly in Mysore and Southern India, and to stimulate research in them. The society publishes a quarterly journal, and has a wide reputation.

Palace. The Palace is situated on the northern outskirts of the city, and is one of the finest in South India. The main building is designed after Windsor Castle, and has an area of 45,000 square feet. The grounds are extensive and well laid out. Visitors may obtain permission to see the Palace, when His Highness is not in residence, by applying to the Superintendent of Government Gardens, Lal Bagh.

Sandalwood Oil Factory. This is situated on the Tumkur Road, near the western end of Sankey's Tank. In it, and in a similar factory located in Mysore, about 150,000 lbs. of sandalwood oil are produced annually, *i.e.* about three-fourths of the world's production. The chief significance of this undertaking is that an industry, which prior to the war was almost entirely in German hands, has been transferred, in all probability permanently, to India. The factory contains a number of stills built in the country, pumps for raising the water of Sankey's Tank to be used in the condensers, and boilers for producing the steam required for distillation. There are elaborate and effective arrangements for dealing with accidental outbreaks of fire. A laboratory is attached, in which the quality of the oil is tested and certified.

Silk Farm. The Salvation Army Tata Silk Farm is near the southern extremity of the Basavangudi Extension, about one mile south of the Lal-Bagh. It covers an area of about 24 acres, of which a portion is planted with mulberry trees. The farm originally belonged to Messrs. Tata Bros., and was handed over by them to the Salvation Army in 1910. The whole process, from the rearing of the worm to the completion of the fabric,

may be seen here. About 80 boys, mostly orphans or rescued from distressing circumstances, are employed, educated, and trained to become worthy citizens.

Transformer Station. "A" Transformer Station is located near the crossing of Sheshadri Road and Subedar's Chattram Road, and receives the high tension lines coming from the Cauvery Power Station at Sivasamudram. From this building the power, reduced to a comparatively low voltage, is distributed by overhead wires to the various parts of the city.

EXCURSIONS

Cauvery Falls. These falls can be reached by road, being about 75 miles from Bangalore, or the visitor can travel by train to Maddur, from which place there is a motor bus service. The branches of the River Cauvery, which enclose the island of Sivasamudram, form the picturesque falls known as Ganganna Chukki on the Mysore side, and Bar Chukki on the Coimbatore side. The falls are about 250 feet in height. Beside the falls, the principal object of interest is the generating station at Sivasamudram, which has been described in a separate article.

Hessarghatta. The reservoir at this place is the source of water supply for the City and Civil and Military Station of Bangalore. It is about four miles long by one in breadth, and the water is carried from it in a masonry channel four and a half miles long to two pumping stations: one for the City, the other for the C. and M. Station. Hessarghatta is 16 miles from Bangalore, and is reached by a road leaving the Tumkur Road at the eighth mile.

Mysore. This ancient and picturesque city is the capital of the State, and is 86 miles distant from Bangalore, whence it can be reached either by road or by rail from the Bangalore City station. It is described in the article on p. 106.

Seringapatam, on the Bangalore-Mysore Road, nine miles from the latter city. It is also a stopping station for all trains running between Bangalore and Mysore. An account of its history and of some of its more interesting features is given on p. 110.

Krishnarajasagara. The great dam across the River Cauvery at Kannambadi can be reached by road, either from Mysore by the Melwal Road, or by taking a road which leaves the Bangalore-Mysore Road at Paschimavahini. The nearest railway station is Belagula, on the Mysore-Arsikere line. The storage works are described in the article on p. 114.

Kolar Gold Field. This important centre of the gold mining industry is about 60 miles from Bangalore by road, and can also be reached by a light railway running from Bowringpet, a station on the Bangalore-Madras line. A short history of the industry and an account of the methods of extracting the metal in use on the Field are given on p. 98.